7 ANALYSIS OF CHECK DAMS

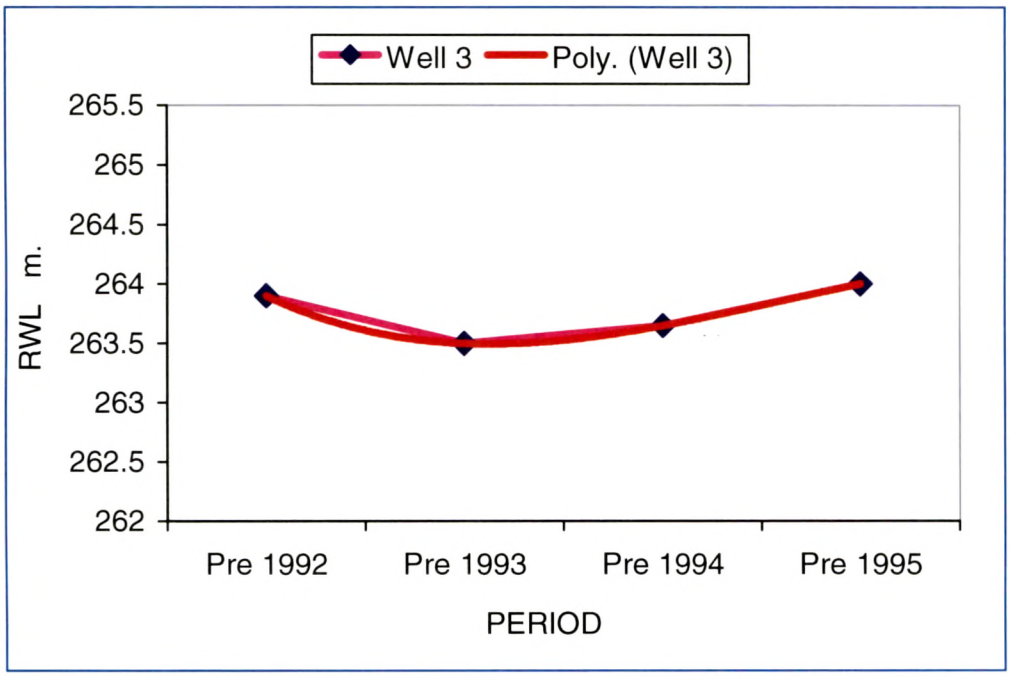
7.1 Impact of Check Dams on Ground Water Table

Total 62 observation wells, scattered in 22 villages are selected in the study area. Table 7.1 gives details of these wells. Table 5.14 to 5.24 represents water levels in m. (BGL) for the wells having consistent longer period data. Data of water levels are processed by working out Reduced Water Levels and analysis is done by plotting pre and post monsoon Reduced Water Levels (R.W.L.) for the period before check dam construction and after check dam construction. Out of graphs of total 62 wells some specimen graphs for 5 Check dams namely Wankol, Simaliya, Kharsana, Bambela and Rajudia are illustrated here.

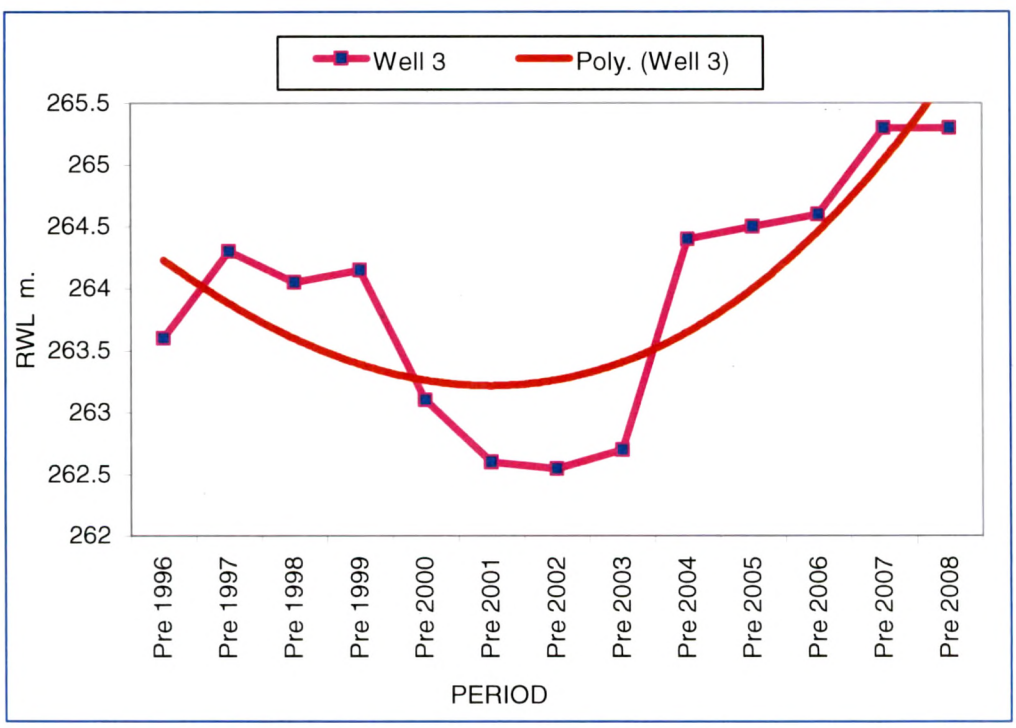
Table 7.1 Details of Observation Wells for Study of Water Levels

Sr. No.	Village	Well No.	Catchment of Check Dam	Sr. No.	Village	Well No.	Catchment of Check Dam
1	Mirakhedi	1	Kachumber	12	Kharsana	35-42	Kharsana
2	Thala	2	Kachumber	13	Mandli Khunta	43	Kharsana
3	Dungri Falia	3	Wankol	14	Melania	44	Kharsana
4	Rupakheda	4	Wankol	15	Munkhosla	45-48	Kharsana
5	Limbadi	5	Simaliya	16	Muvada	49	Kharsana
6	Raliyatbhura	6	Simaliya	17	Anwarpura	50-51	Bambela
7	Simaliya	7	Simaliya	18	Bhanpur	52-53	Bambela
8	Therka	8-26	Therka	19	Dhavadia	54-57	Bambela
9	Chitrodia	27-32	Kharsana	20	Mahudi	58-60	Mahudi
10	Kadval	33	Kharsana	21	Dahod	61	Rajudia
11	Kalia Talav	34	Kharsana	22	Dhadhela	62	Rajudia

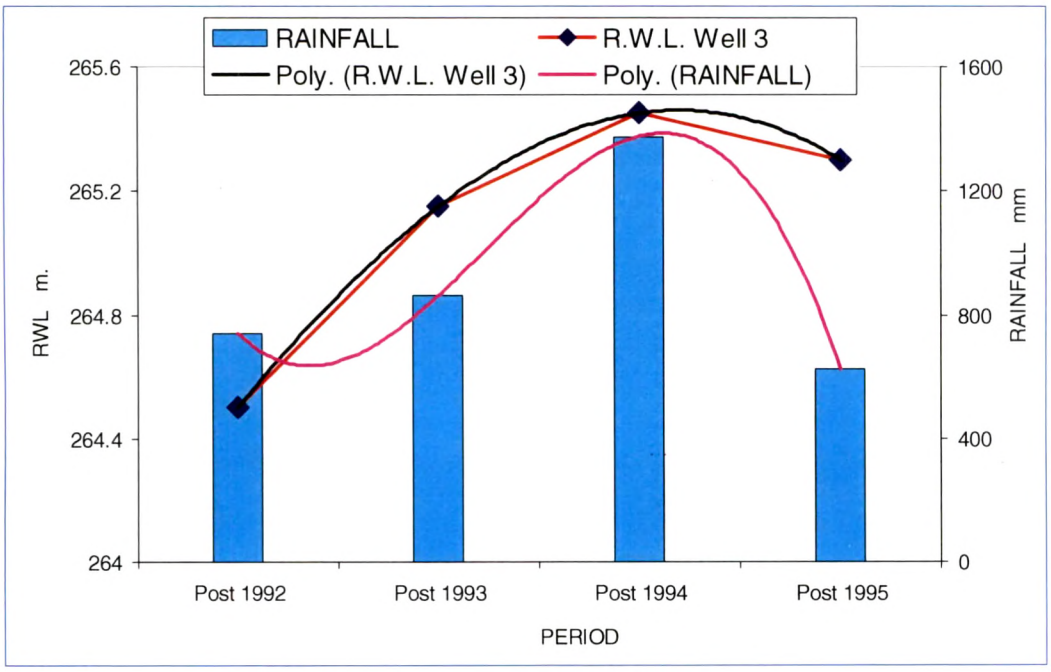
7.1.1 Wankol Check Dam



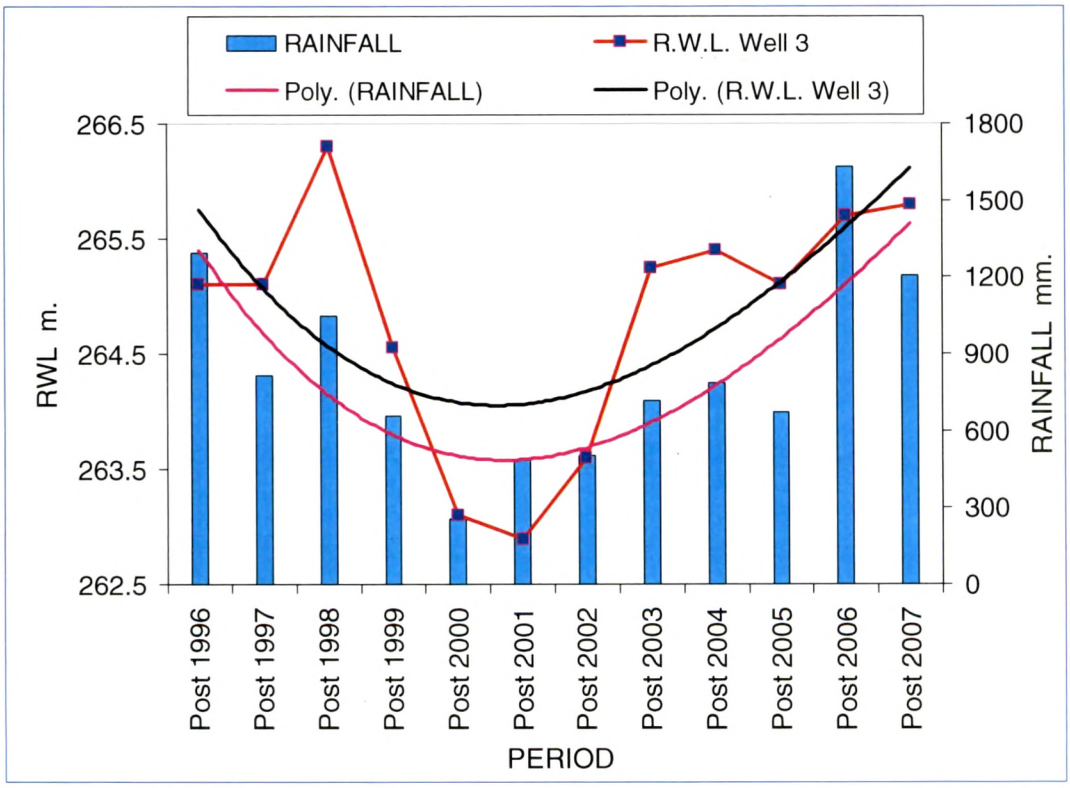
Graph – 7.1 Pre-monsoon R.W.L.s At Dungri Falia (Before Check Dam)



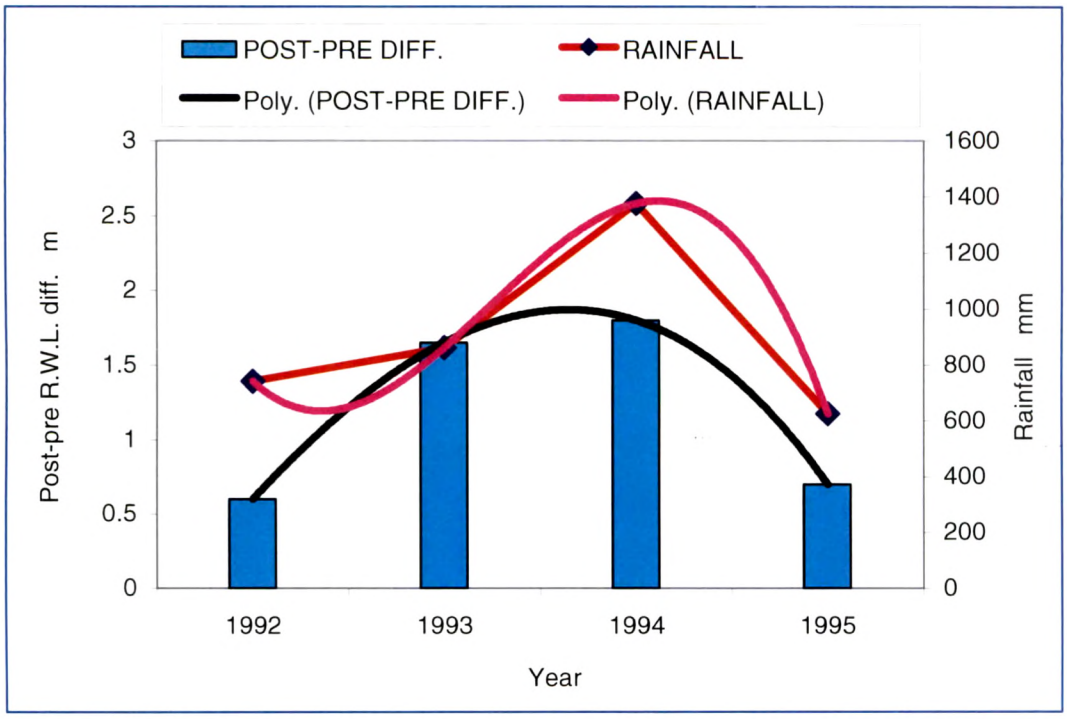
Graph – 7.2 Pre-monsoon R.W.L.s At Dungri Falia (After Check Dam)



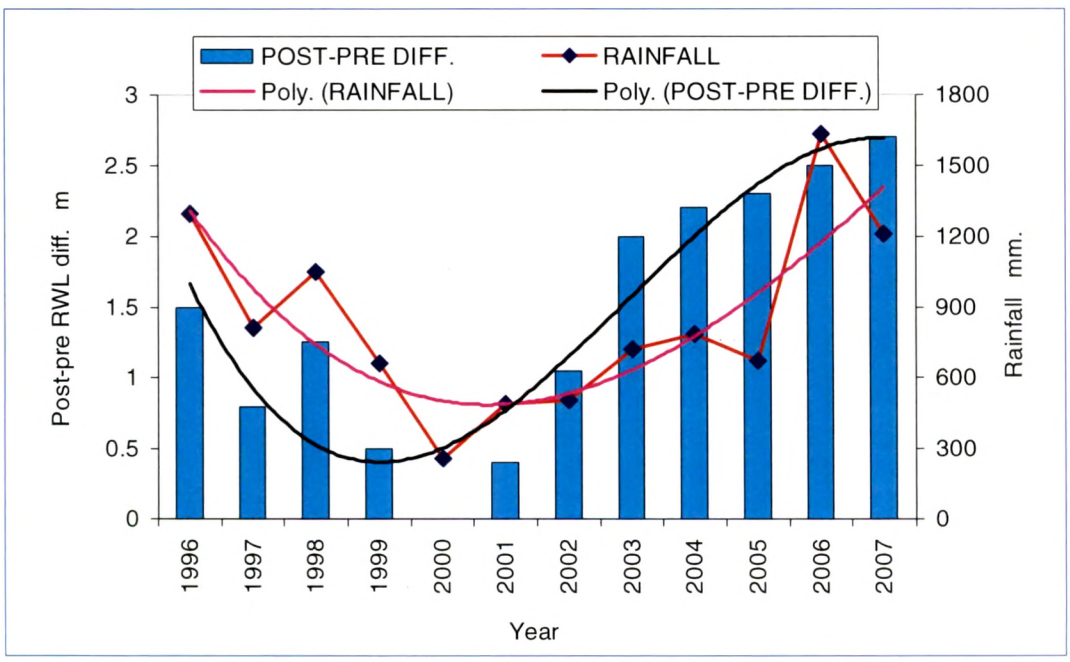
Graph – 7.3 Post-monsoon R.W.L.s at Dungri Falia (Before Check Dam)



Graph – 7.4 Post-monsoon R.W.L.s at Dungri Falia (After Check Dam)

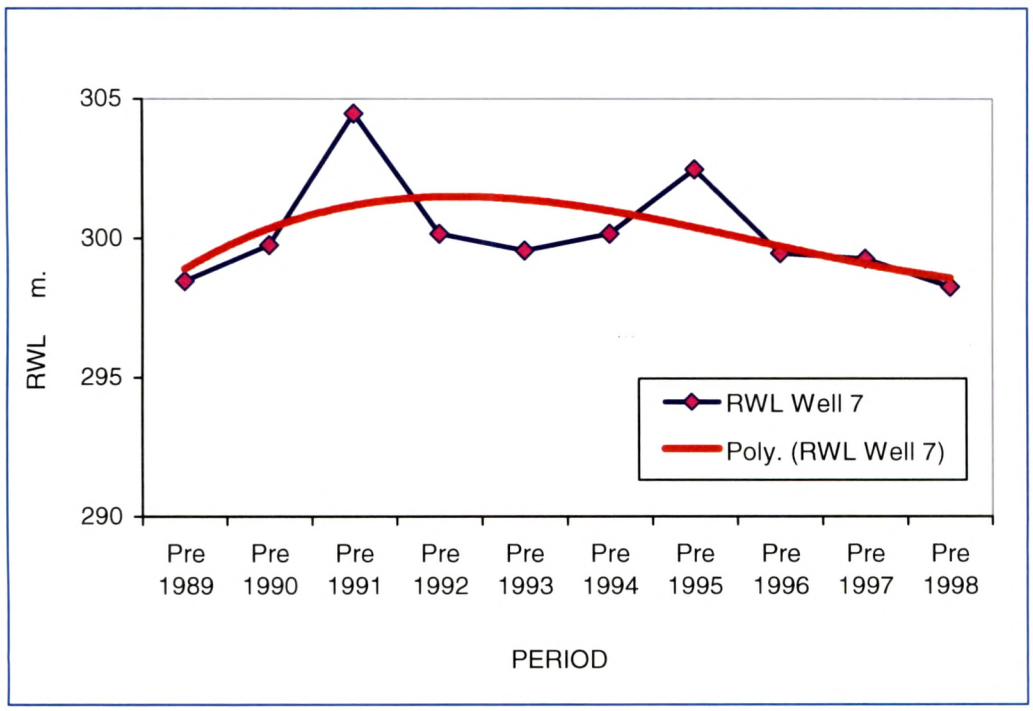


Graph 7.5 Post-pre Difference of R.W.L. variation at Dungri Falia (Before Check Dam)

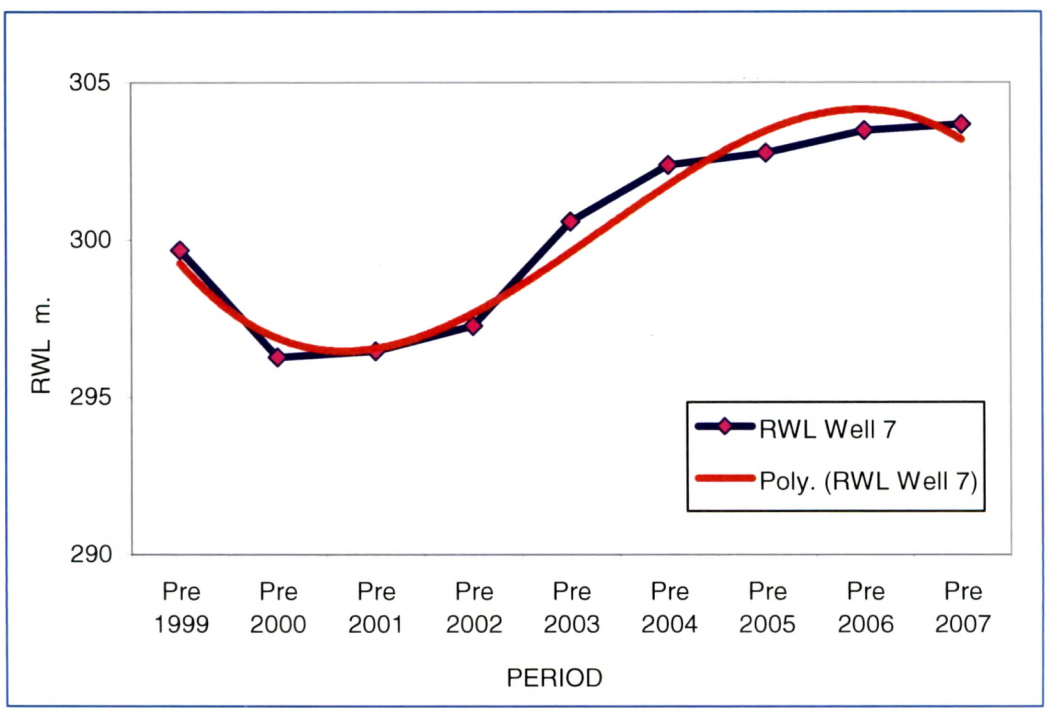


Graph 7.6 Post-pre R.W.L. Difference of R.W.L. Variation at Dungri Falia (After Check Dam)

7.1.2 Simaliya Check Dam

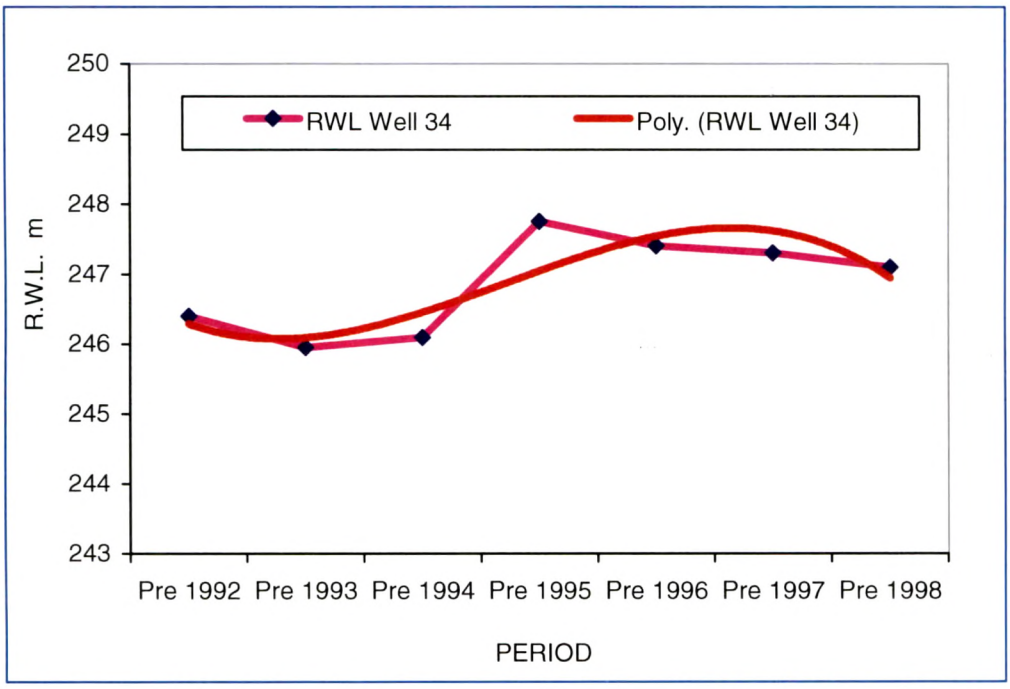


Graph – 7.7 Pre-monsoon R.W.L.s at Simaliya (Before Check Dam)

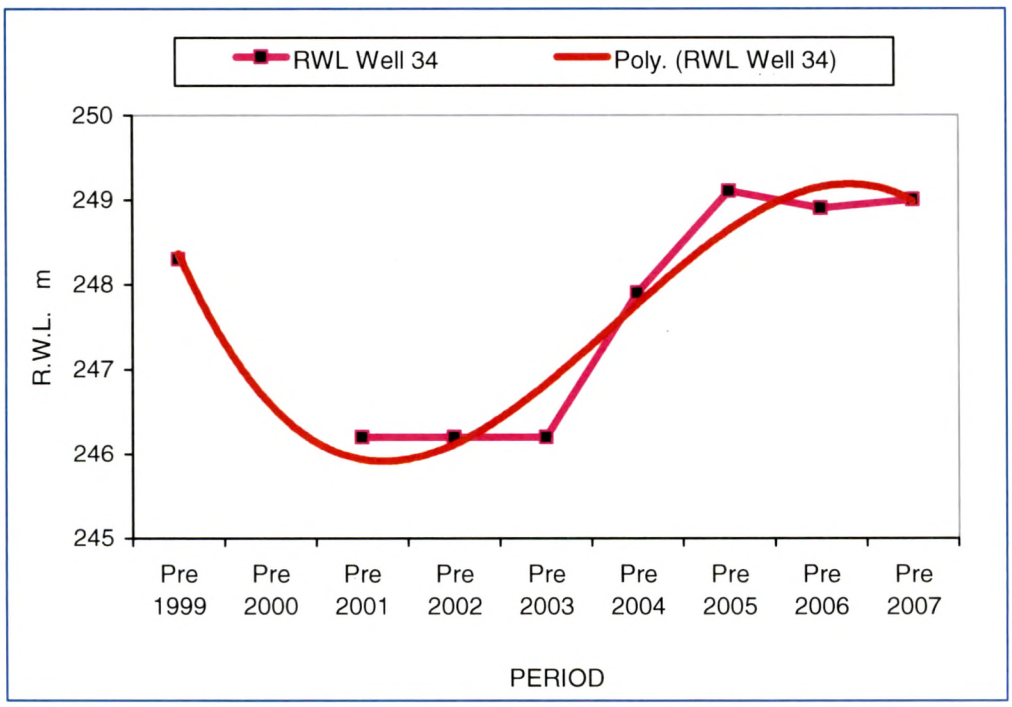


Graph – 7.8 Pre-monsoon R.W.L.s at Simaliya (After Check Dam)

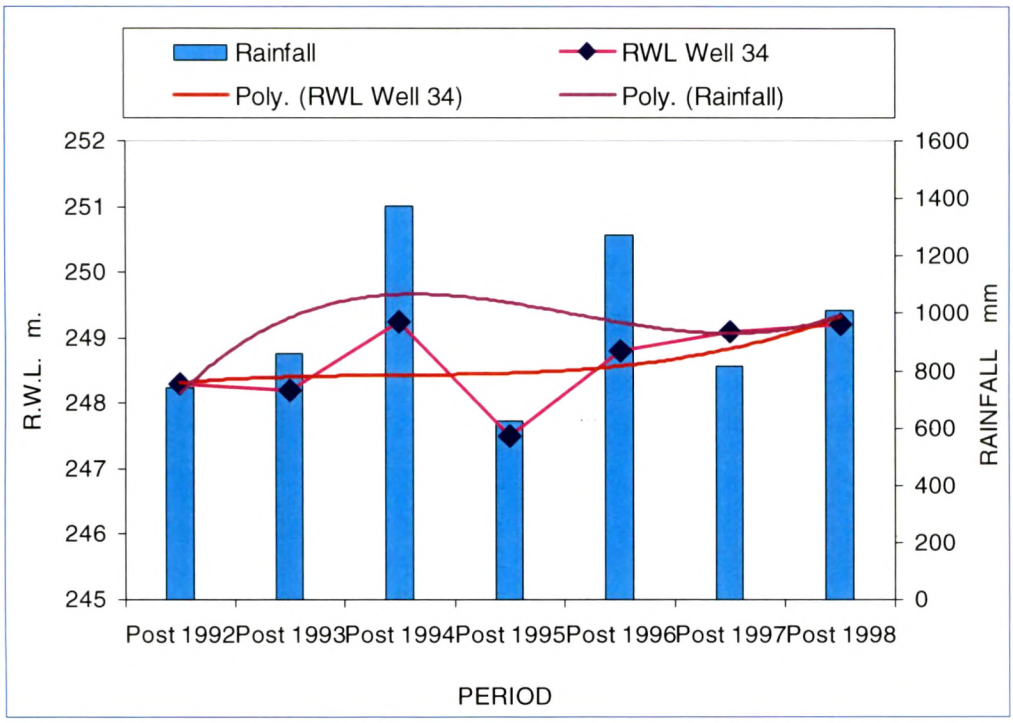
7.1.3 Kharsana Check Dam



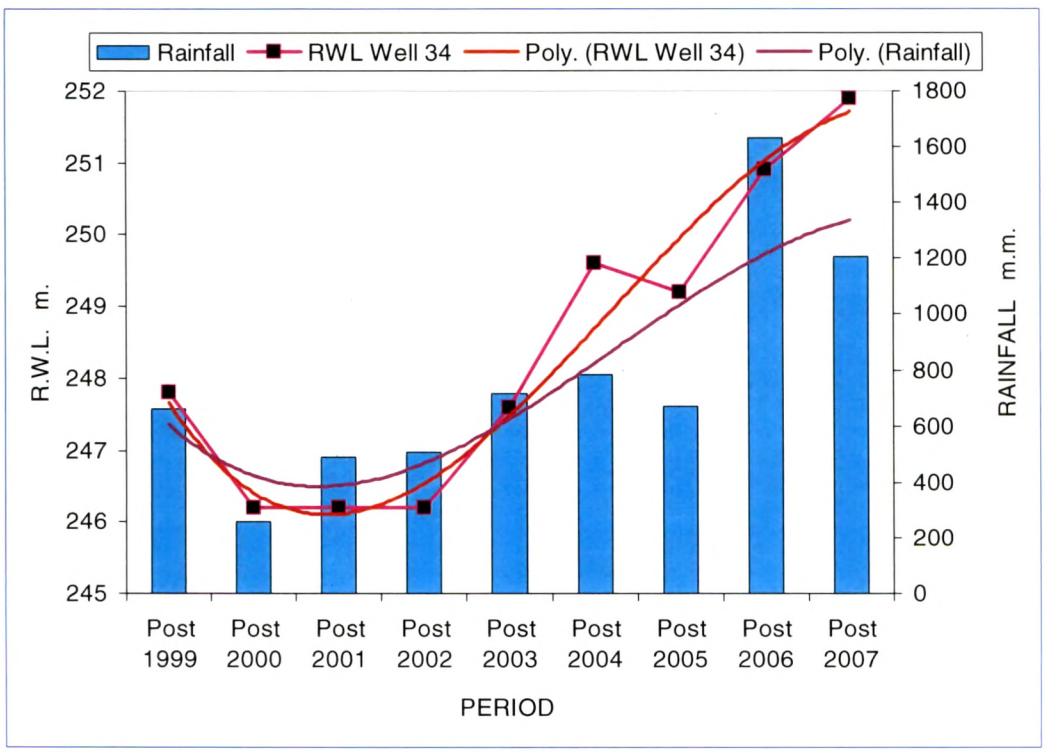
Graph – 7.9 Pre-monsoon R.W.L.s at Kalia Talav (Before Check Dam)



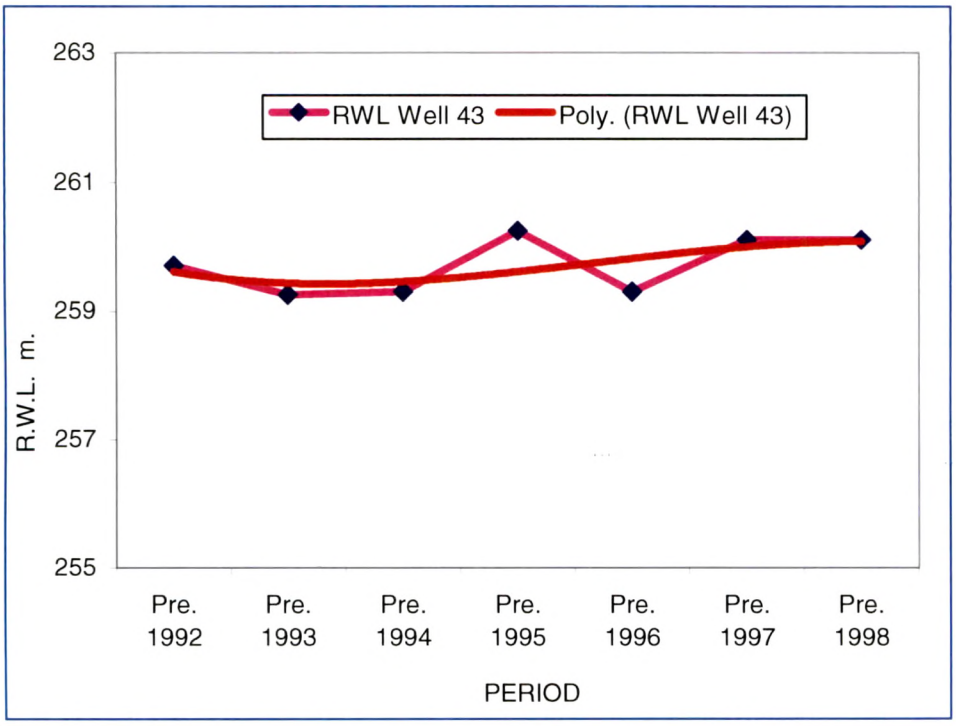
Graph – 7.10 Pre-monsoon R.W.L.s at Kalia Talav (After Check Dam)



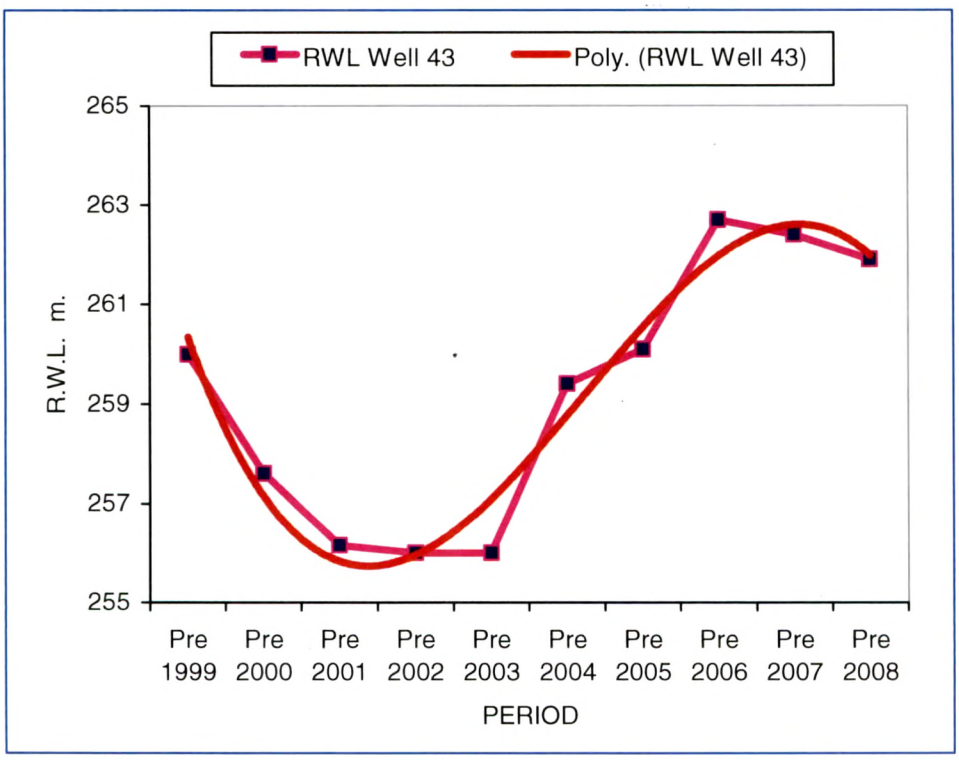
Graph – 7.11 Post-monsoon R.W.L.s at Kalia Talav (Before Check Dam)



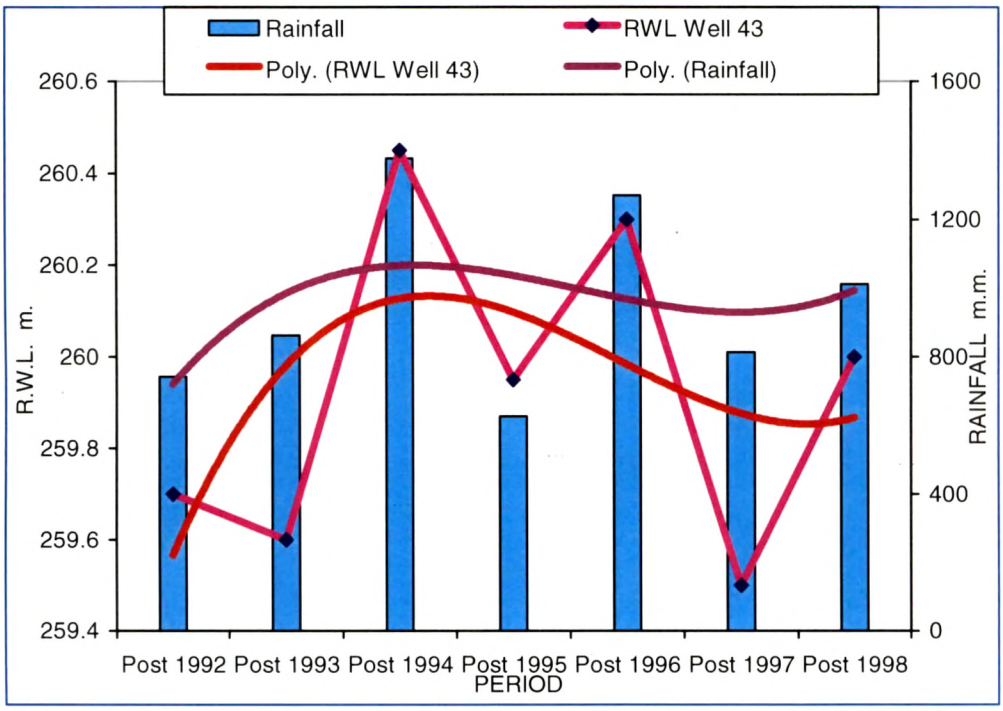
Graph – 7.12 Post-monsoon R.W.L.s at Kalia Talav (After Check Dam)



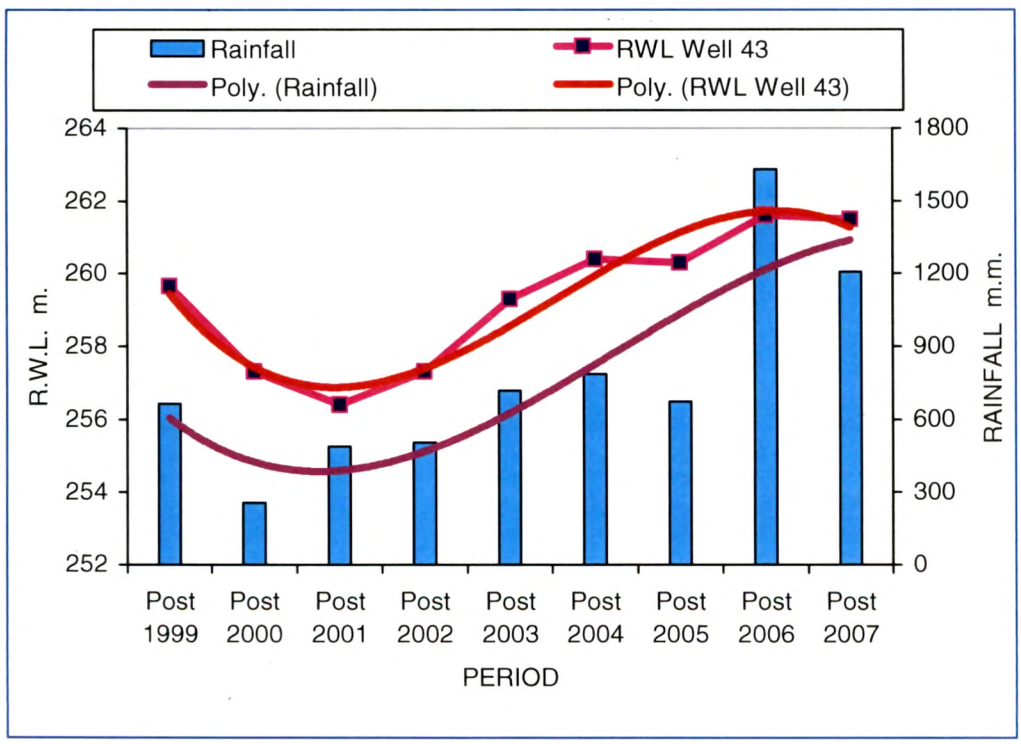
Graph – 7.13 Pre-monsoon R.W.L.s at Mandli Khunta (Before Check Dam)



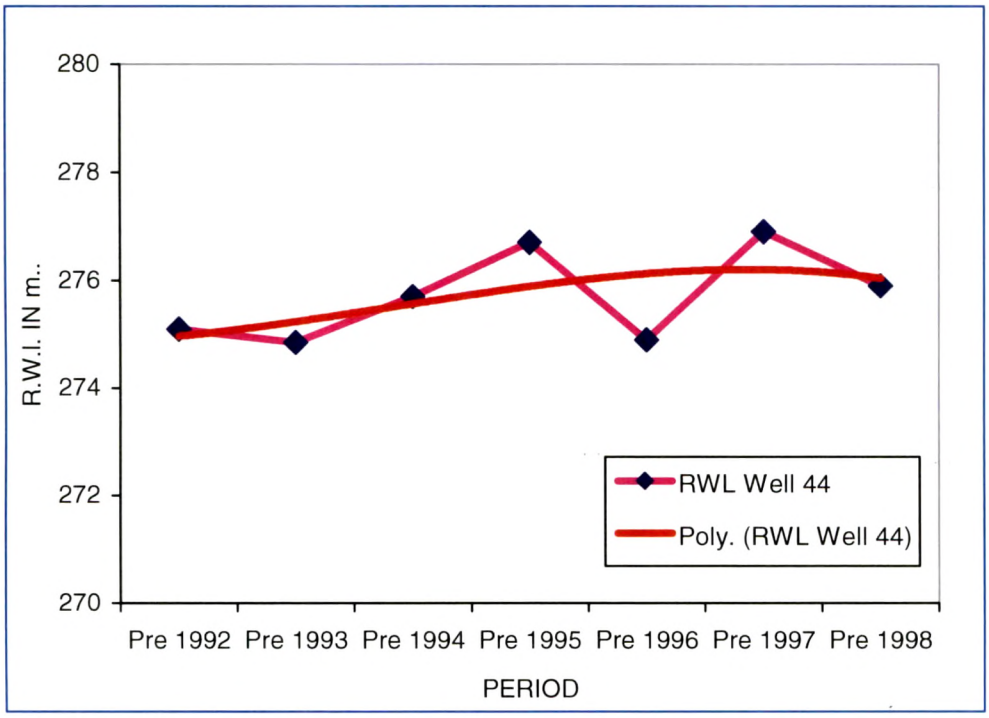
Graph – 7.14 Pre-monsoon R.W.L.s at Mandli Khunta (After Check Dam)



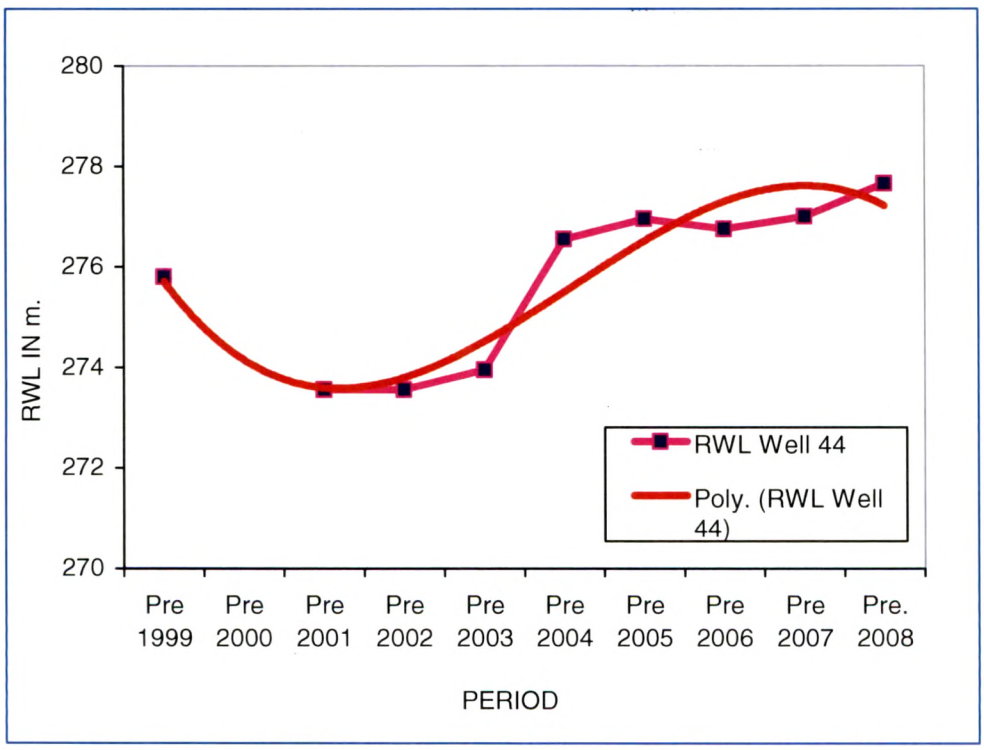
Graph – 7.15 Post-monsoon R.W.L.s at Mandli Khunta (Before Check Dam)



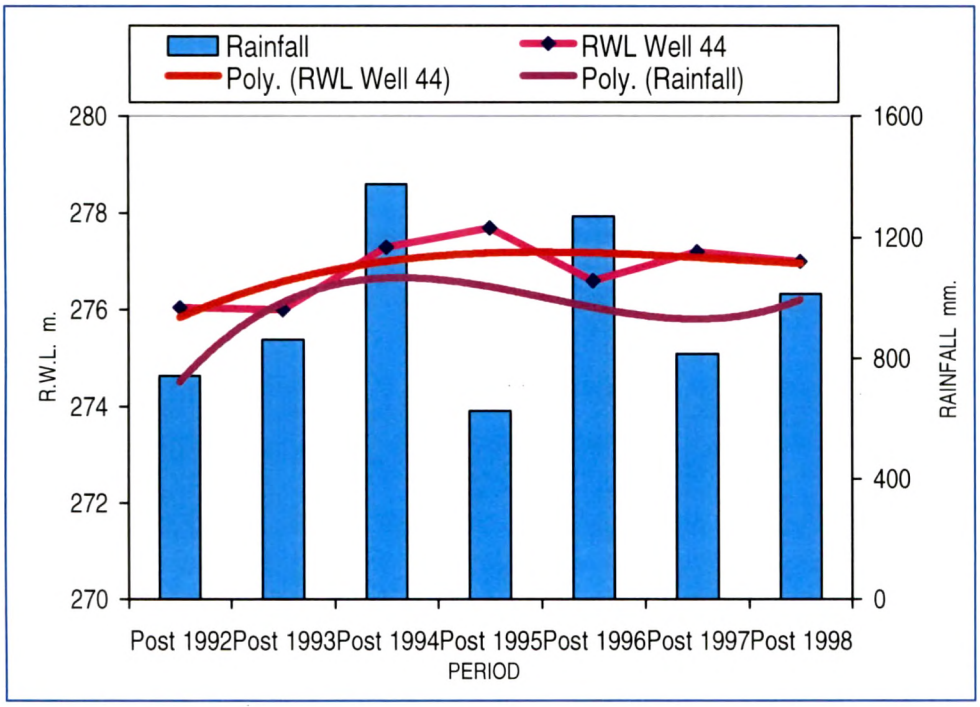
Graph – 7.16 Post-monsoon R.W.L.s at Mandli Khunta (After Check Dam)



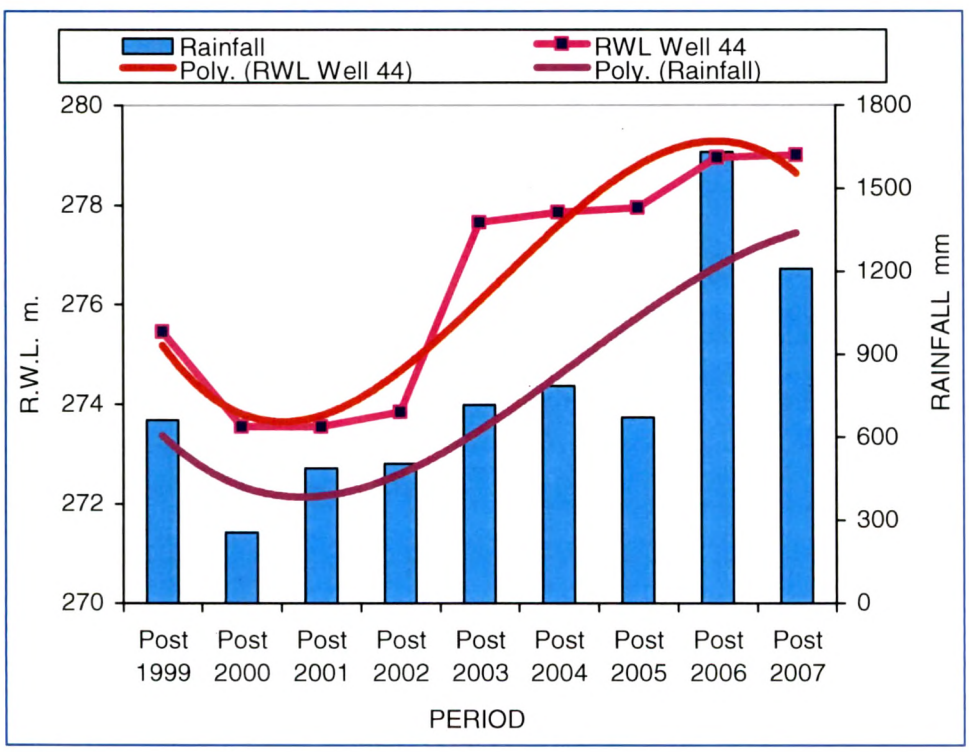
Graph – 7.17 Pre-monsoon R.W.L.s at Melania (Before Check Dam)



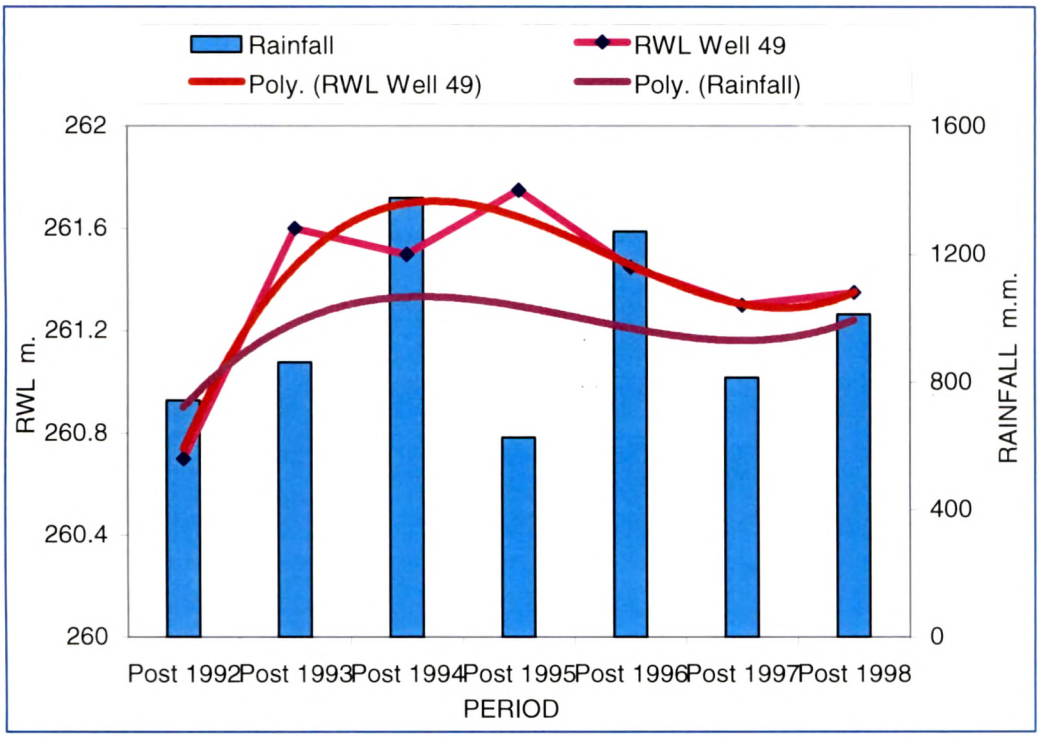
Graph – 7.18 Pre-monsoon R.W.L.s at Melania (After Check Dam)



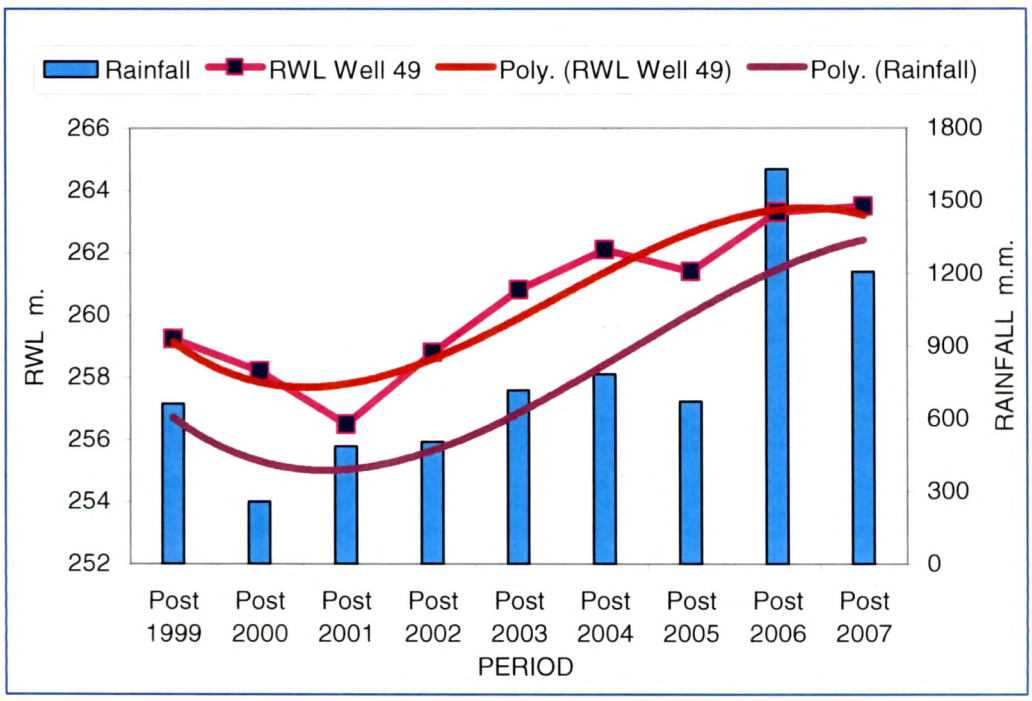
Graph – 7.19 Post-monsoon R.W.L.s at Melania (Before Check Dam)



Graph – 7.20 Post-monsoon R.W.L.s at Melania (After Check Dam)

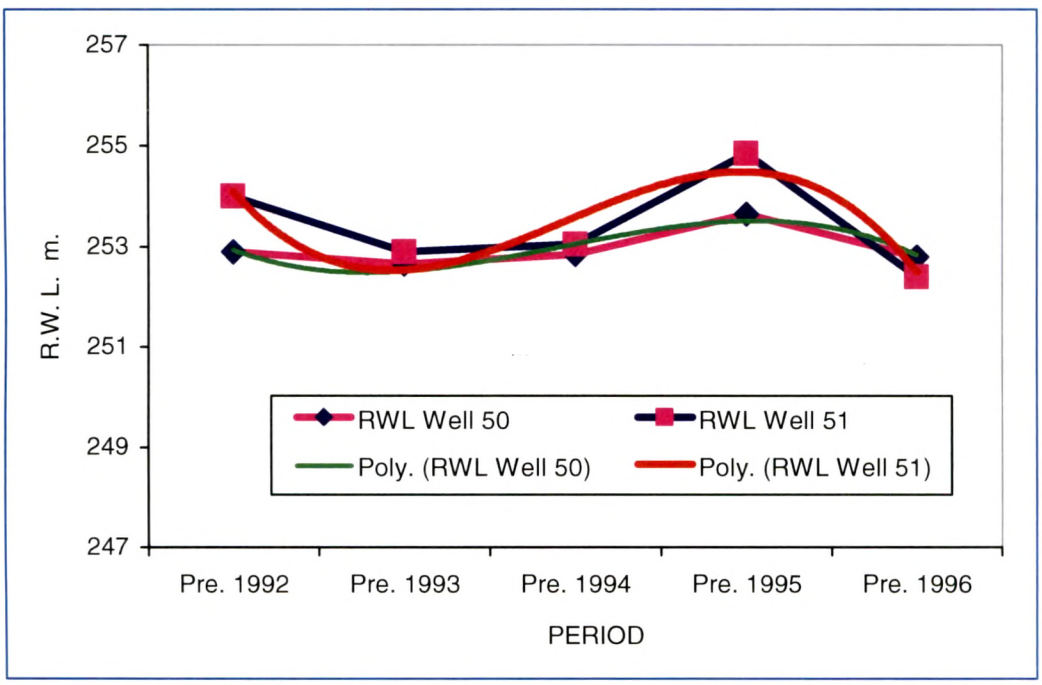


Graph – 7.21 Post-monsoon R.W.L.s at Muvada (Before Check Dam)

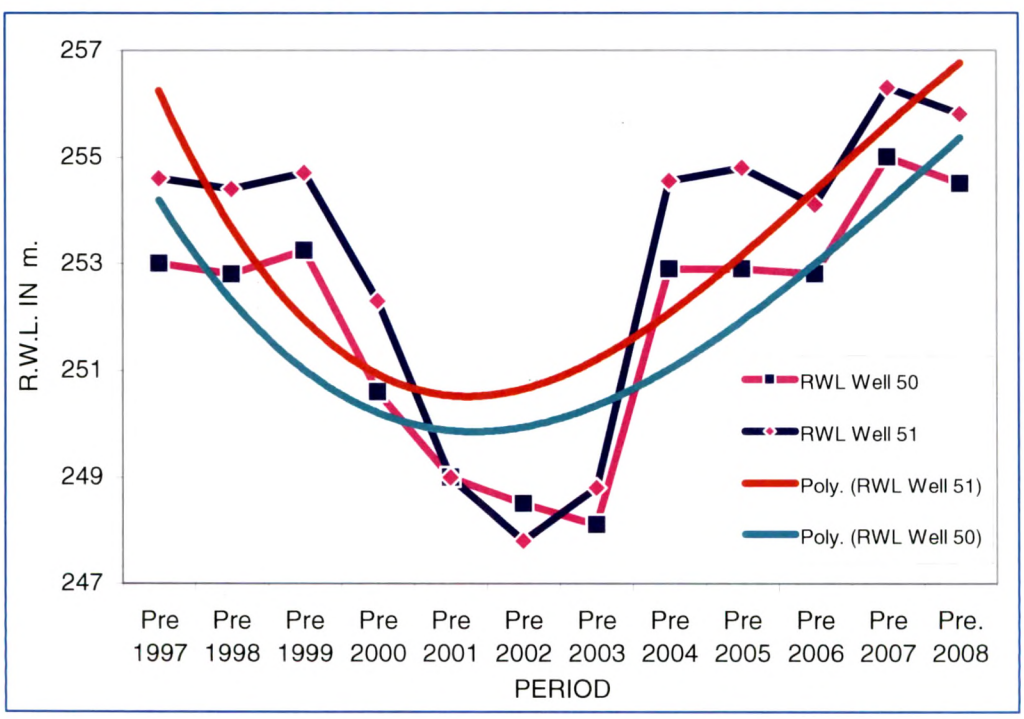


Graph – 7.22 Post-Monsoon R.W.L.s at Muvada (After Check Dam)

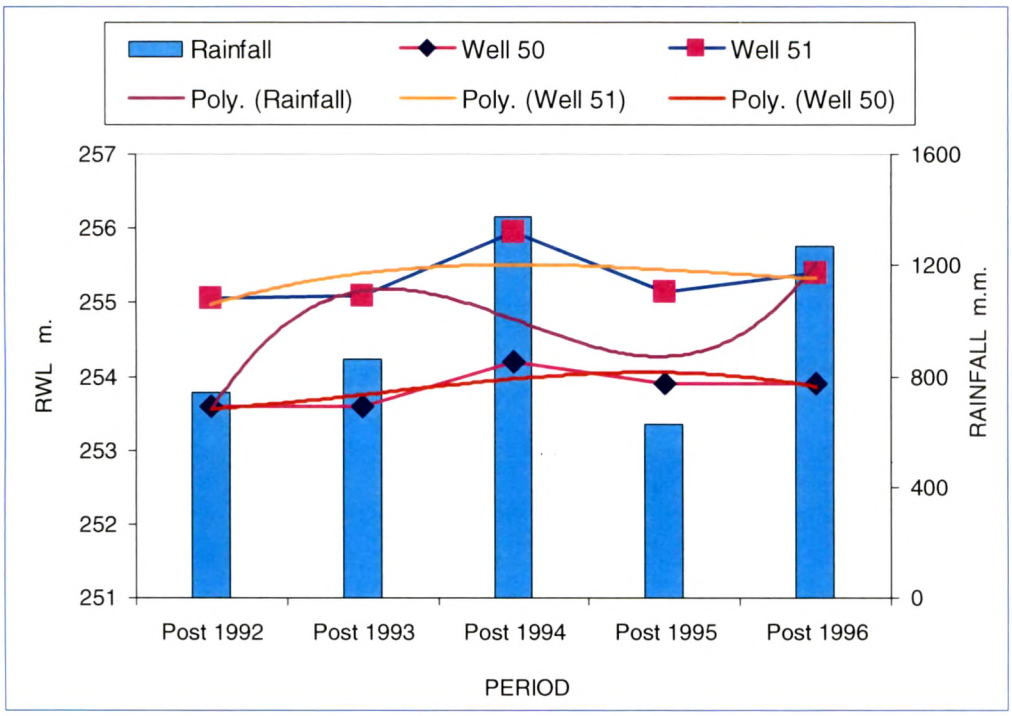
7.1.4 Bambela Check Dam



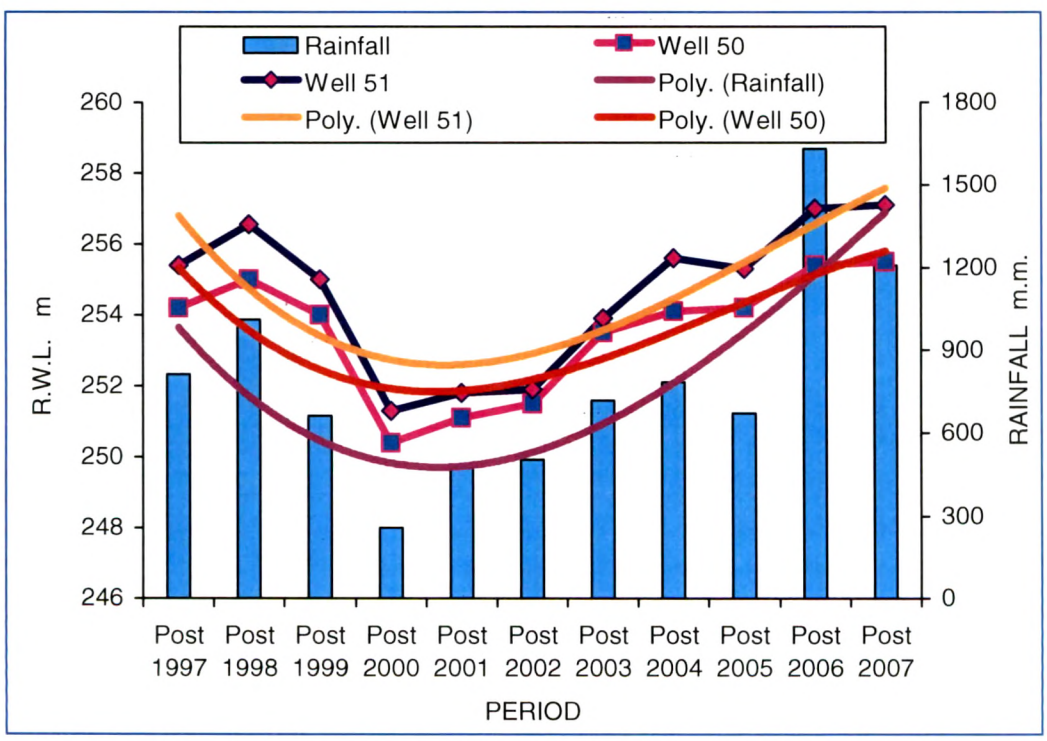
Graph – 7.23 Pre-Monsoon R.W.L.s at Anwarpura (Before Check Dam)



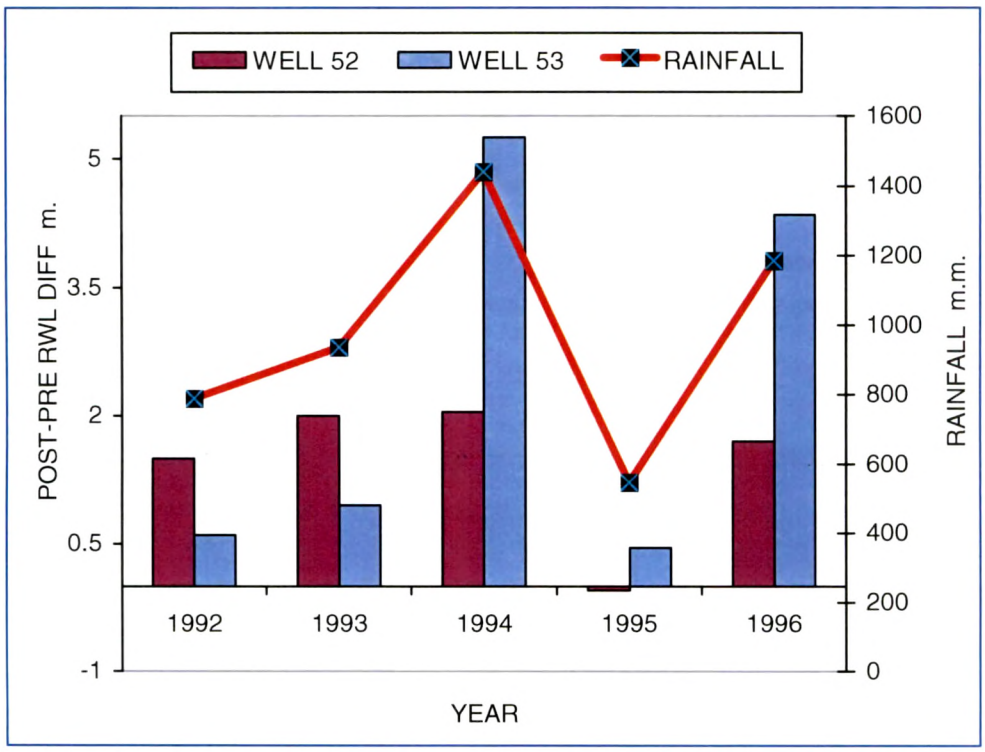
Graph – 7.24 Pre-Monsoon R.W.L.s at Anwarpura (After Check Dam)



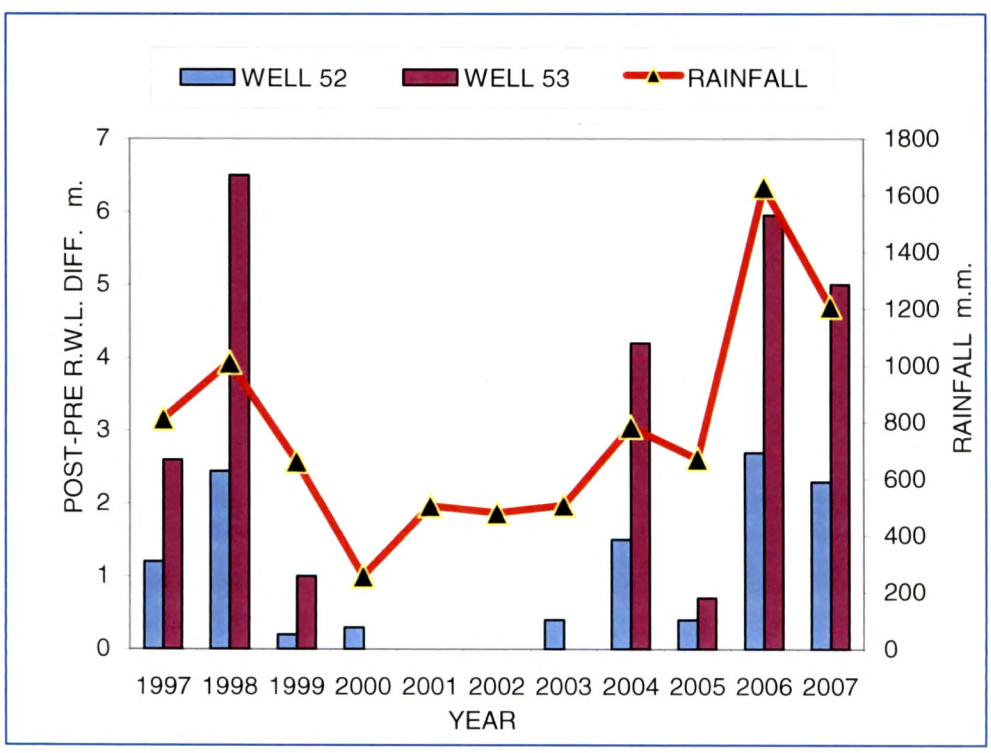
Graph – 7.25 Post-Monsoon R.W.L.s at Anwarpura (Before Check Dam)



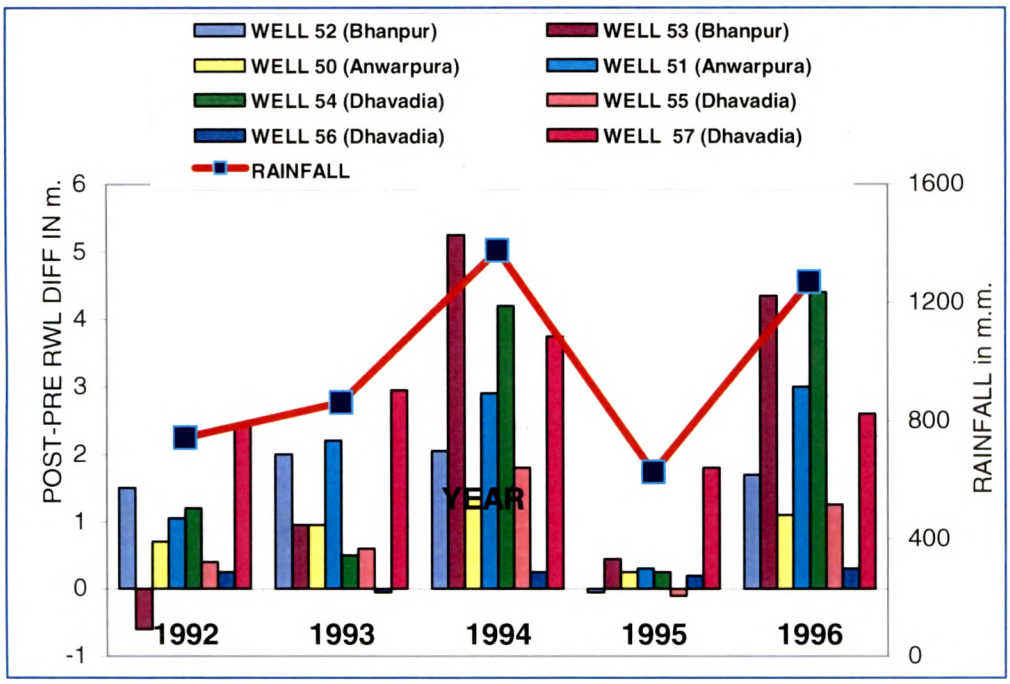
Graph – 7.26 Post-Monsoon R.W.L.s at Anwarpura (After Check Dam)



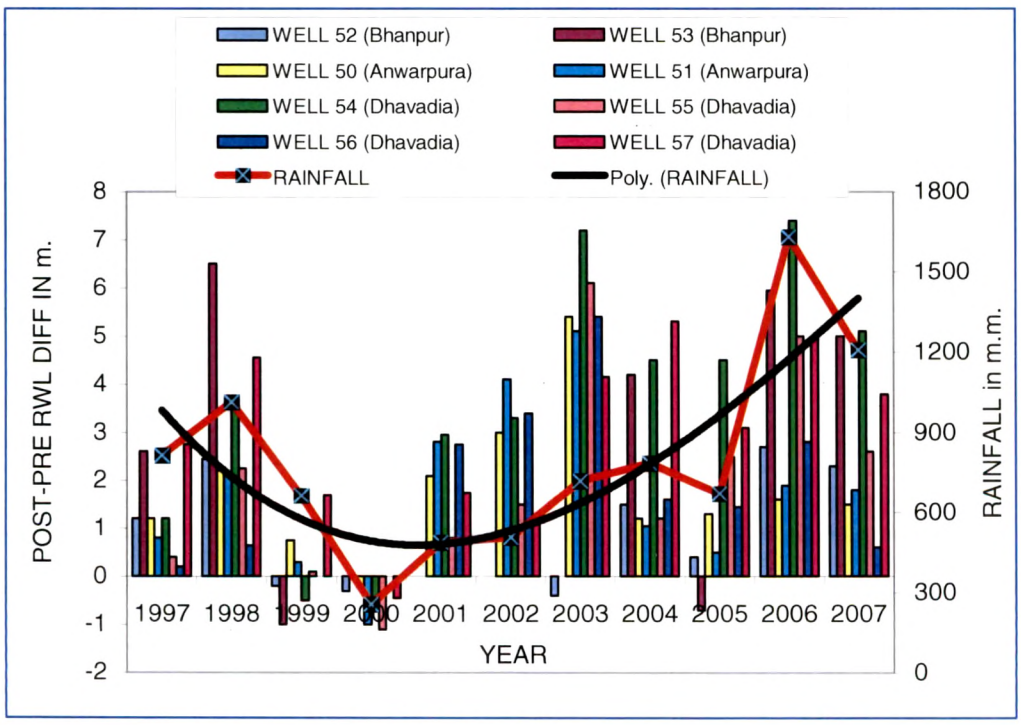
Graph – 7.27 Post-Pre R.W.L. Difference at Bhanpur (Before Check Dam)



Graph – 7.28 Post-Pre R.W.L. Difference at Bhanpur (After Check Dam)

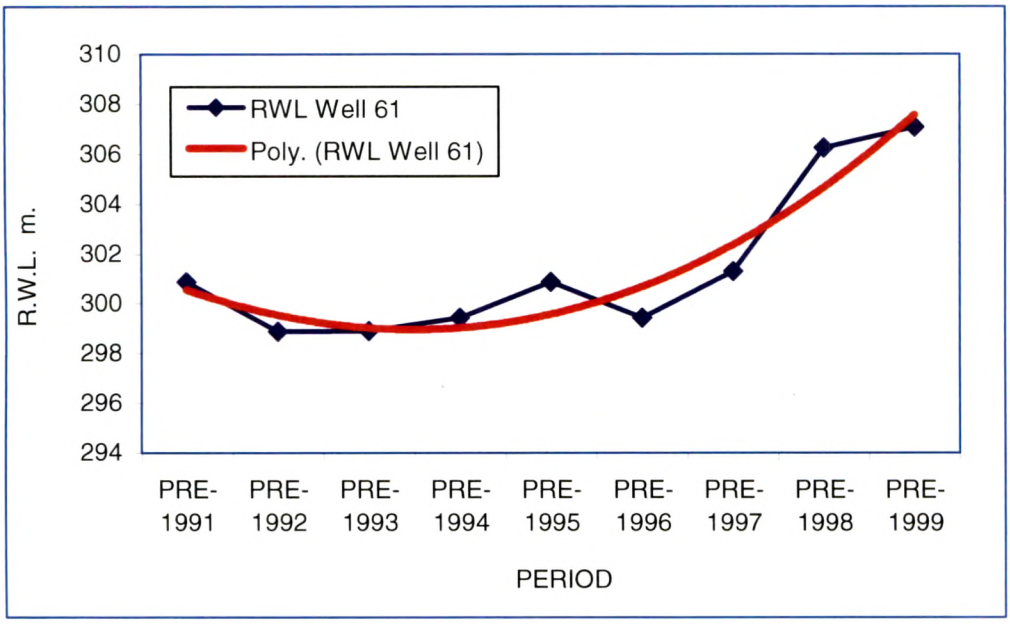


Graph – 7.29 Post-Pre R.W.L. Diff. In 3 Villages of Bambela Check Dam (Before Check Dam)

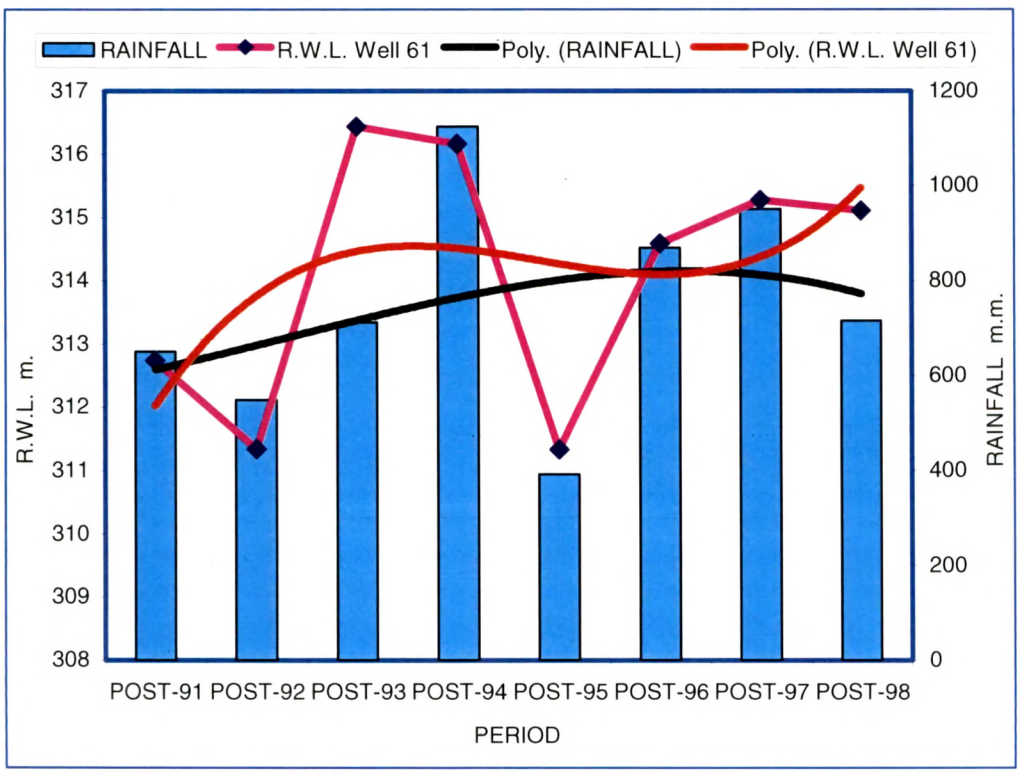


Graph 7.30 Post Pre R.W.L. Diff. In 3 Villages of Bambela Check Dam (After Check Dam)

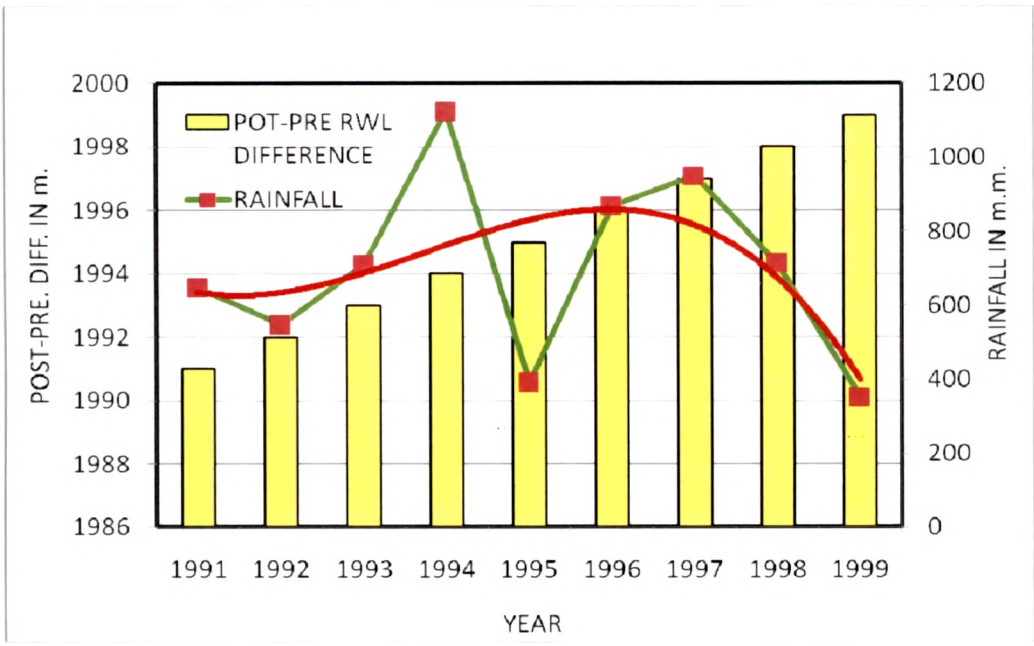
7.1.5 Rajudia Check Dam



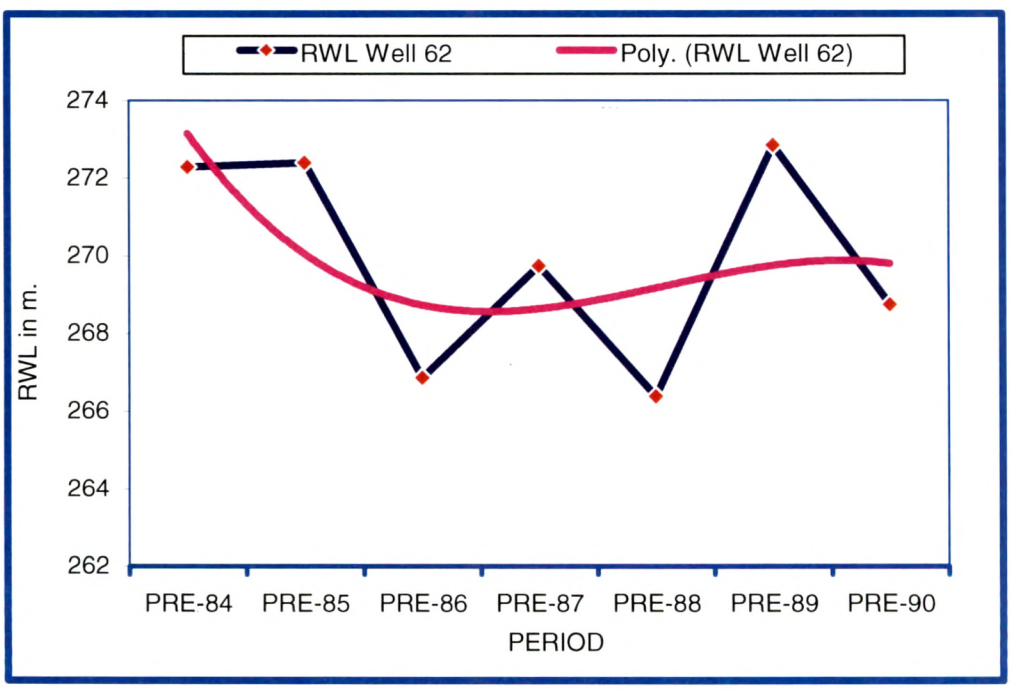
Graph – 7.31 Pre-monsoon R.W.L.s in at Dahod (After Check Dam)



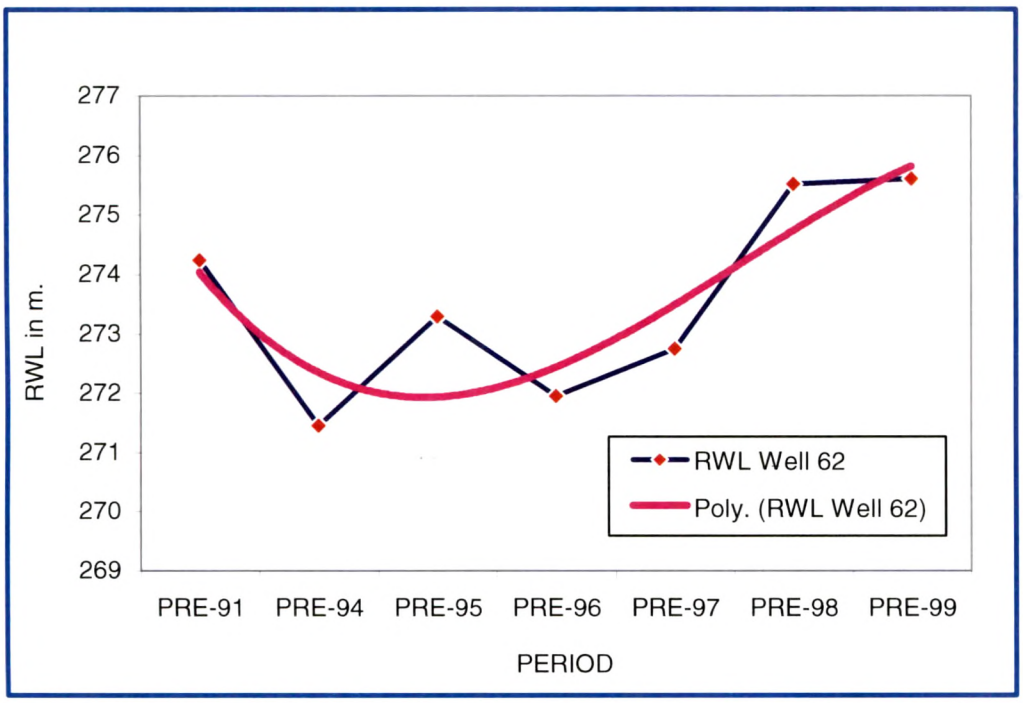
Graph – 7.32 Post-Monsoon R.W.L.s at Dahod (After Check Dam)



Graph – 7.33 Post-Pre R.W.L. Difference at Dahod (After Check Dam)



Graph – 7.34 Pre-Monsoon R.W.L.s at Dhadhela (Before Check Dam)



Graph – 7.35 Pre-monsoon R.W.L.s at Dhadhela (After Check Dam)

7.1.6 Discussion on Analysis of Ground Water Levels

Ground water flow pattern in the Machhan River basin broadly follows the topography and drainage pattern of the basin. Study of the water table conditions in 1980's shows that during 1980 and 1981 there was no area having ground water table within 1.5 m. from ground. 99 % area had water table at more than 5 m below ground level. Only in a little area of hardly 1% water table was between 1.5 to 3.0 m. The average depth to water levels ranged between 5.81 to 7.23 m for the period pre-monsoon 1982-1991. This was the period when none of the check dam was constructed on river Machhan.

Study of water table after construction of check dams on Machhan River shows noticeable difference in scenario explained above. After check dams significant rise have been observed in overall water table conditions. Post-monsoon water table which was varying following rainfall pattern appears to vary at much steeper rate showing more rise in response of small increase in rainfall. Also there observed general decline in the water table

from post-monsoon of one year to pre-monsoon of next year which is an indicative of good internal drainage.

One can refer the example of Dungri Falia. Post-pre difference of Dungri Falia indicate that before check dam construction there observed less rise in water table for considerable rise in rainfall, for example for rise of rainfall from 862 to 1375 in 1993 to 1994 the rise in post-pre water level difference is 1.65 to 1.8 m. Whereas after check dam for rise of rainfall from 506 mm to 718 mm, in 2002 to 2003, 1.05 m to 3.05 m rise is observed. Here one should remember that year 2002 was the consecutive third year of severe drought and year 2003 was a year of rainfall less than normal average rainfall in spite of this such a remarkable rise in water table is observed. This clearly indicates that check dam has caused rise in ground water level significantly even in less rainfall period.

Rainfall in year 2000 was 257 mm, lowest amongst all the year studied. Due to this 73 % wells were observed dry during this year. Entire area had water levels below 5 m. During pre-monsoon 2001. The rainfall in year 2001 was 488 mm. More than previous year however still it was very less to normal annual rainfall of the region. 68 % of wells were observed dry during this year. There was no considerable change in water levels during pre-monsoon 2002. In 2003 rainfall was 718 mm, less than normal average rainfall of the region, still water table raised during post-monsoon 2003 (Refer Graphs 7.4, 7.12, 7.16, 7.20, 7.22, 7.26, etc.) Water levels again raised during pre-monsoon 2004 compared to pre-monsoon 2003 whereas the rainfall in year 2004 was 785.1 mm, still less than the normal annual rainfall of the region. (Refer Graphs 7.2, 7.8, 7.10, 7.14, 7.18, 7.24 etc.)

One can infer from this study that in general Pre-monsoon water levels have risen after construction of check dams. Post-monsoon water table shows reasonably stable behavior even during less rainfall for many consecutive days.

7.2 Analysis of Check Dams

7.2.1 Storage Calculations of Check Dams

Table – 7.2 Storage Calculations for Kachumber Check Dam

R.L.	C/S area	Width	Perimeter	Dist. from C.D.	Wetted area	Storage Volume	Storage Equivalent Depth
m.	m^2	m.	m.	m.	m^2	m^3	m.
97.40	25.13	17.09	21.9	450.81	5590.04	11328.86	2.03
97.18	23.05	16.07	20.1	418.01	5191.68	9635.13	1.86
96.96	22.63	15.97	19.08	385.12	4814.00	8715.27	1.81
96.74	19.483	14.52	18.43	352.30	4174.76	6863.86	1.64
96.52	16.13	13.67	17.58	319.50	3514.50	5153.54	1.47
96.30	15.93	13.02	15.43	286.66	3110.26	4566.49	1.47
96.08	14.67	12.71	14.99	253.86	2388.82	3724.13	1.56
95.86	12.83	11.87	13.48	220.95	1966.46	2834.79	1.44
95.64	10.33	11.37	12.78	188.15	1730.98	1943.59	1.12
95.42	9.43	10.77	11.18	155.33	1335.84	1464.76	1.10
95.20	8.1	9.62	10.39	122.33	955.40	990.87	1.04
94.98	6.3	8.67	9.38	89.54	608.87	564.10	0.93
94.76	2.15	7.69	9.23	56.80	377.72	122.12	0.32
94.54	1.83	6.87	8.98	24.00	153.60	43.92	0.29

Table – 7.3 Storage Calculations for Wankol Check Dam

R.L.	C/S area	Width	Perimeter	Dist. from C.D.	Wetted area	Storage Volume	Storage Equivalent Depth
m.	m^2	m.	m.	m.	m^2	m^3	m
97.30	11.00	12.82	12.28	471.81	5850.44	5189.91	0.89
97.15	10.1	12.40	12.3	439.01	5452.50	4346.20	0.80
97.00	9.90	12.70	12.38	406.12	5076.50	3573.86	0.70
96.85	8.80	12.25	11.73	373.30	4423.61	3285.04	0.74
96.70	7.47	11.90	10.88	340.50	3745.50	2543.54	0.68
96.55	6.77	11.75	10.73	307.66	3338.11	2082.86	0.62
96.40	5.75	11.44	9.29	274.86	2586.43	1580.45	0.61
96.25	4.75	10.60	8.78	241.95	2153.36	1149.26	0.53
96.10	4.15	10.10	9.08	209.15	1924.18	867.97	0.45
95.95	3.70	9.50	8.48	176.33	1516.44	652.42	0.43
95.80	3.05	8.35	7.69	143.33	1119.41	437.16	0.39
95.65	2.10	7.40	6.68	110.54	751.67	232.13	0.31
95.50	1.05	6.42	6.53	77.80	517.37	81.69	0.16
95.35	0.80	5.60	6.28	45.00	288.00	36.00	0.13

Table – 7.4 Storage Calculations for Simaliya Check Dam

R.L.	C/S area	Width	Perimeter	Dist. from C.D.	Wetted area	Storage Volume	Storage Equivalent Depth
m.	m^2	m.	m.	m.	m^2	m^3	m.
99.50	25.66	19.09	20.7	428.02	8860.01	10982.99	1.24
99.30	23.58	18.07	19.9	395.22	7864.88	9319.29	1.18
99.08	23.16	17.97	18.88	362.33	6840.79	8391.56	1.23
98.86	20.013	16.52	18.23	329.51	6006.97	6594.48	1.10
98.64	16.66	15.67	17.38	296.71	5156.82	4943.19	0.96
98.42	16.46	15.02	15.23	263.87	4018.74	4343.30	1.08
98.20	15.2	14.71	14.79	231.07	3417.53	3512.26	1.03
97.98	13.36	13.87	13.28	198.16	2631.56	2647.42	1.01
97.76	10.86	13.37	12.58	165.36	2080.23	1795.81	0.86
97.54	9.96	12.77	10.98	132.54	1455.29	1320.10	0.91
97.32	8.63	11.62	10.19	99.54	1014.31	859.03	0.85
97.10	5.3	8.67	9.18	66.75	612.77	353.78	0.58

Table – 7.5 Storage Calculations for Therka Check Dam

R.L.	C/S area	Width	Perimeter	Dist. from C.D.	Wetted area	Storage Volume	Storage Equivalent Depth
m.	m^2	m.	m.	m.	m^2	m^3	m.
99.40	19.75	22.03	24.98	1137.46	28413.75	22464.84	0.79
99.25	19.44	21.17	24.09	1101.66	26538.99	21416.27	0.81
99.10	19.10	20.59	22.99	1065.77	24502.05	20356.21	0.83
98.95	18.80	20.26	22.24	1029.95	22906.09	19363.06	0.85
98.80	18.48	19.43	21.33	994.15	21205.22	18371.89	0.87
98.65	18.19	18.89.	20.56	958.31	19702.85	17431.66	0.88
98.50	17.90	18.45	19.87	922.51	18330.27	16512.93	0.90
98.35	17.54	18.07	19.45	886.60	17244.37	15550.96	0.90
98.20	17.25	17.27	18.83	850.80	16020.56	14676.30	0.92
98.05	16.91	16.72	18.28	814.98	14897.83	13781.31	0.93
97.90	16.58	15.90	17.08	778.98	13304.98	12915.49	0.97
97.75	16.22	15.10	16.22	743.19	12054.54	12054.54	1.00
97.60	15.91	14.82	15.51	707.45	10972.55	11255.53	1.03
97.45	15.50	14.75	15.55	671.65	10444.16	10410.58	1.00
97.30	15.00	14.30	15.6	635.85	9919.26	9537.75	0.96
97.15	14.35	13.85	15.39	599.97	9233.54	8609.57	0.93
97.00	12.30	13.40	14.2	564.17	8011.21	6939.29	0.87
96.85	11.00	12.80	13.5	528.37	7133.00	5812.07	0.81
96.70	9.90	12.45	13.52	492.52	6658.87	4875.95	0.73
96.55	10.00	12.70	13.6	456.72	6211.39	4567.20	0.74
96.40	8.80	12.25	12.95	420.86	5450.14	3703.57	0.68
96.25	7.70	11.70	12.1	385.04	4658.98	2964.81	0.64
96.10	7.27	11.55	11.95	349.24	4173.42	2538.97	0.61
95.95	6.50	11.32	10.51	313.41	3293.94	2037.17	0.62
95.80	4.75	10.30	10	277.75	2777.50	1319.31	0.48
95.65	4.30	10.10	10.3	241.95	2492.09	1040.39	0.42
95.50	3.70	9.50	9.7	206.20	2000.14	762.94	0.38
95.35	3.25	8.35	8.91	170.40	1518.26	553.80	0.36
95.20	2.20	7.40	7.9	134.60	1063.34	296.12	0.28
95.05	1.85	7.42	7.75	98.80	765.70	182.78	0.24
94.90	1.40	6.60	7.5	63.00	472.50	88.20	0.19

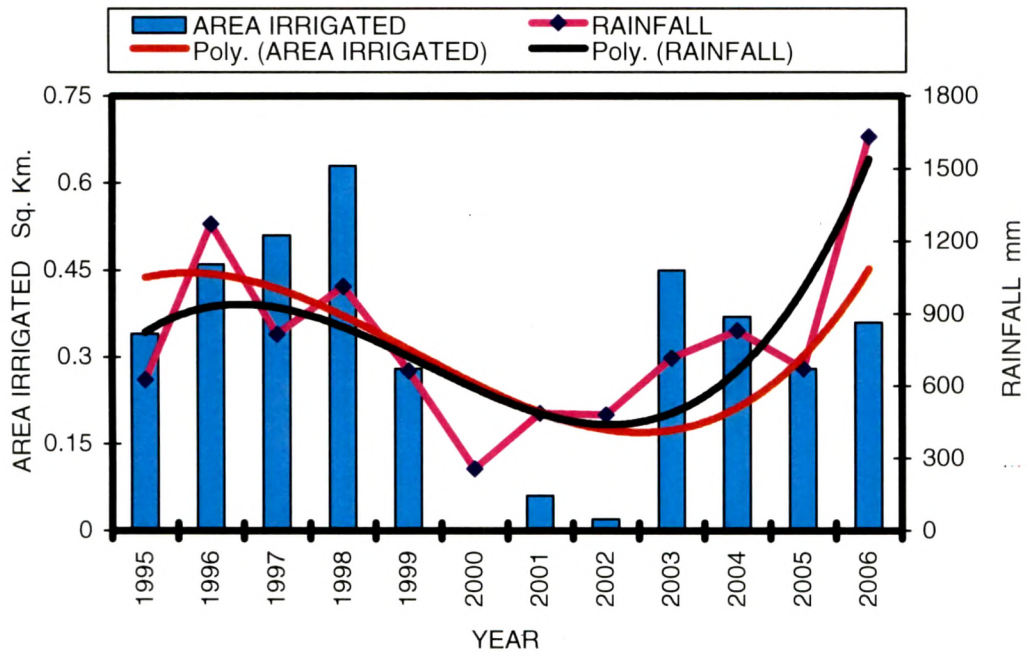
Table – 7.6 Storage Calculations for Mahudi Check Dam

R.L.	C/S area	Width	Perimeter	Dist. from C.D.	Wetted area	Storage Volume	Storage Equivalent Depth
m.	m^2	m.	m.	m.	m^2	m^3	m.
96.25	24.75	25.2	25.17	2099.9	52854.483	51972.525	0.98
96.15	23.82	24.85	24.87	2028.3	50443.821	48314.106	0.96
96.05	23.6	24.05	23.95	1956.9	46867.755	46182.84	0.99
95.95	23.2	23.5	23.65	1884.9	44577.885	43729.68	0.98
95.85	22.83	22.65	22.7	1813.5	41166.45	41402.205	1.01
95.75	22.52	21.7	21.25	1742	37017.5	39229.84	1.06
95.65	22.25	20	20.52	1670.9	34286.868	37177.525	1.08
95.55	20.18	18.82	19.33	1599.6	30920.268	32279.928	1.04
95.45	18.24	17.67	18.17	1528.4	27771.028	27878.016	1.00
95.35	16.44	16.57	17.05	1457.4	24848.67	23959.656	0.96
95.25	14.76	15.53	15.99	1385.7	22157.343	20452.932	0.92
95.15	13.2	14.55	14.99	1314.6	19705.854	17352.72	0.88
95.05	11.76	13.64	14.06	1243.2	17479.392	14620.032	0.84
94.95	10.42	12.78	13.18	1172.2	15449.596	12214.324	0.79
94.85	9.17	11.98	12.35	1101.2	13599.82	10098.004	0.74
94.75	7.97	11.22	11.58	1030.1	11928.558	8209.897	0.69
94.65	6.91	10.52	10.83	958.6	10381.638	6623.926	0.64
94.55	6.9	9.85	10.13	887.2	8987.336	6121.68	0.68
94.45	5.06	9.2	9.47	815.9	7726.573	4128.454	0.53
94.35	4.29	8.59	8.72	744.9	6495.528	3195.621	0.49
94.25	3.6	7.98	8.19	673.8	5518.422	2425.68	0.44
94.15	2.95	7.38	7.55	602.6	4549.63	1777.67	0.39
94.05	2.37	6.77	6.95	531.2	3691.84	1258.944	0.34
93.95	1.85	6.16	6.27	459.6	2881.692	850.26	0.30
93.85	1.38	5.52	5.61	388.5	2179.485	536.13	0.25
93.75	0.97	4.85	4.91	317.5	1558.925	307.975	0.20
93.65	0.62	4.12	4.16	246.3	1024.608	152.706	0.15
93.55	0.33	3.29	3.32	175	581	57.75	0.10
93.45	0.11	2.28	2.29	104	238.16	11.44	0.05

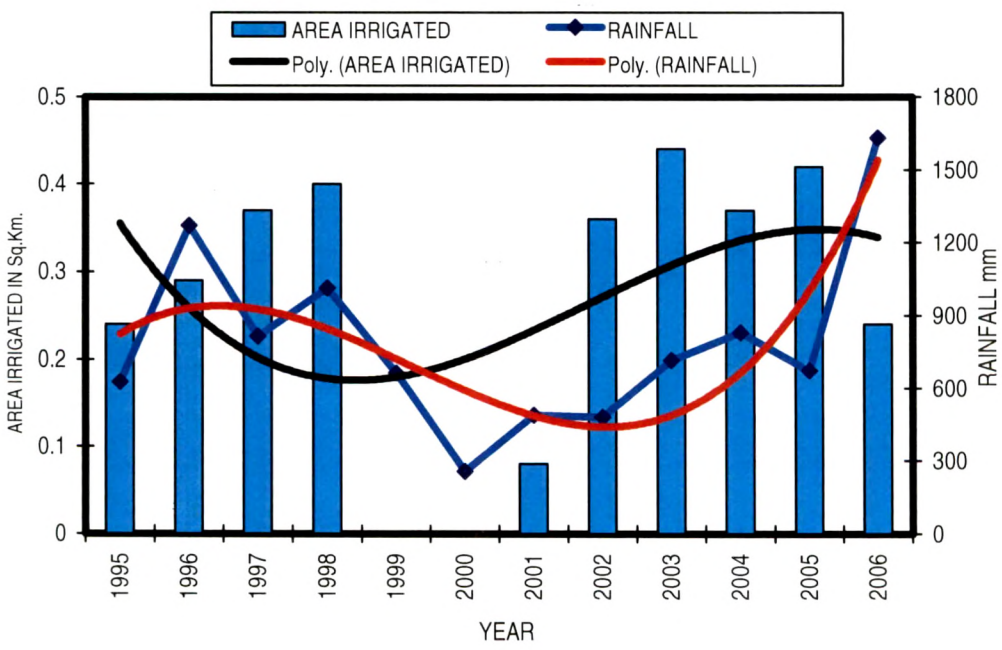
7.3 Analysis of irrigation From Check Dams

7.3.1 Area Irrigated By Different Check Dams Individually

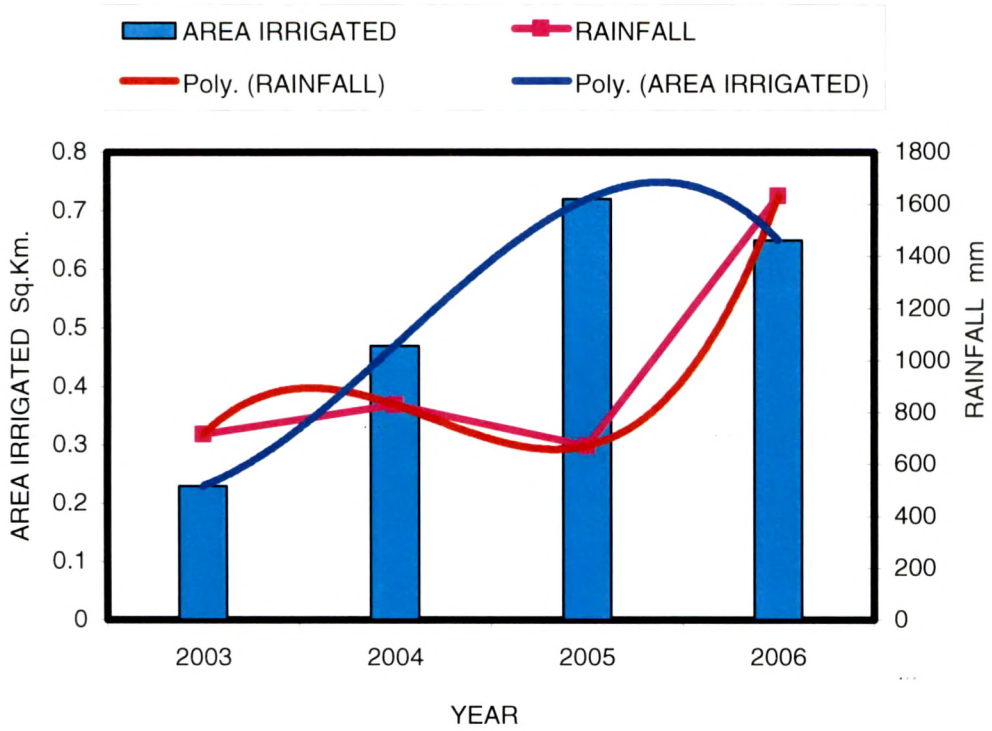
(Refer Table 5.9 Data Collection)



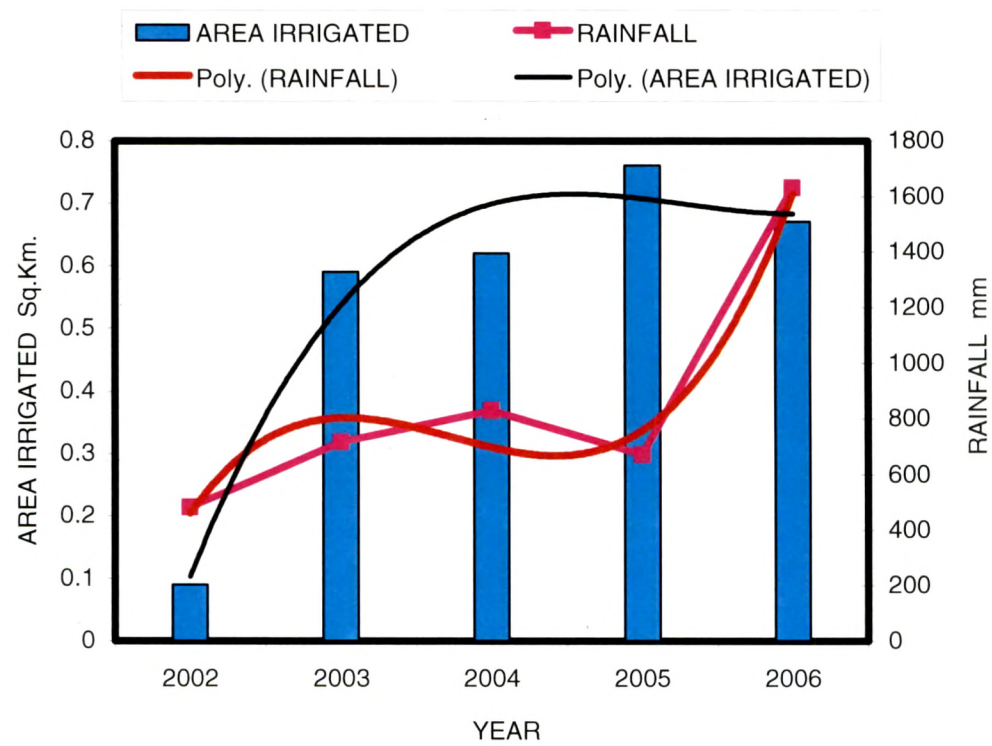
Graph – 7.36 Area Irrigated by Kachumber Check Dam



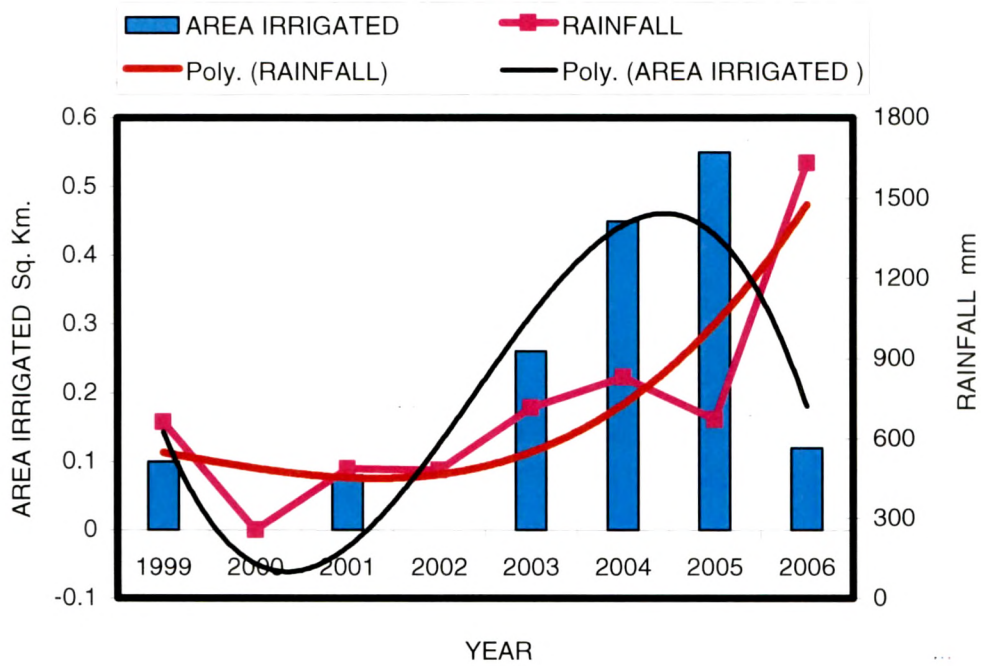
Graph – 7.37 Area Irrigated by Wankol Check Dam



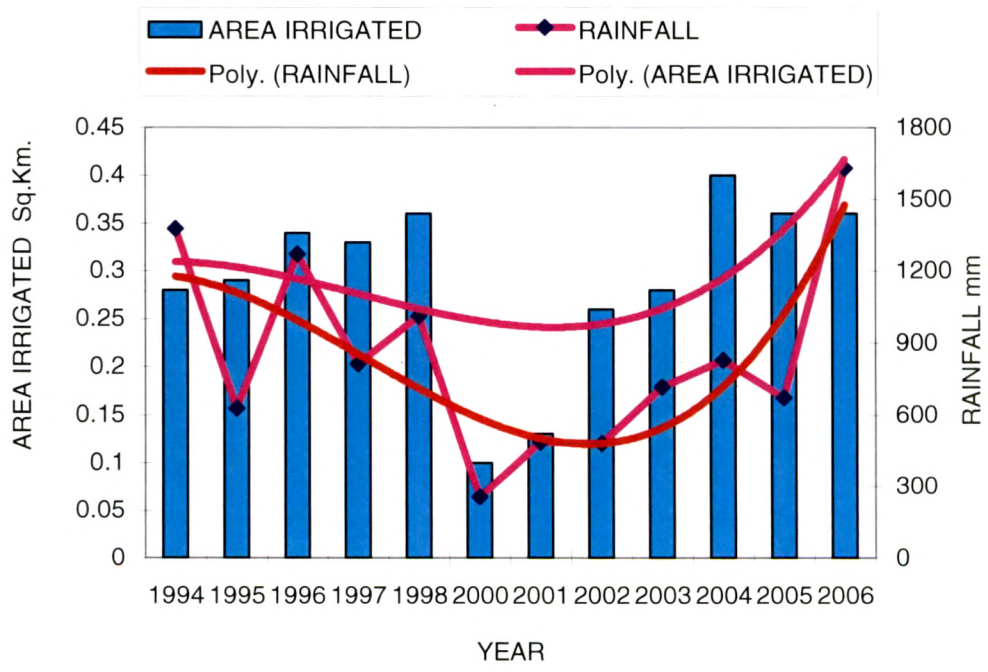
Graph – 7.38 Area Irrigated by Simaliya Check Dam



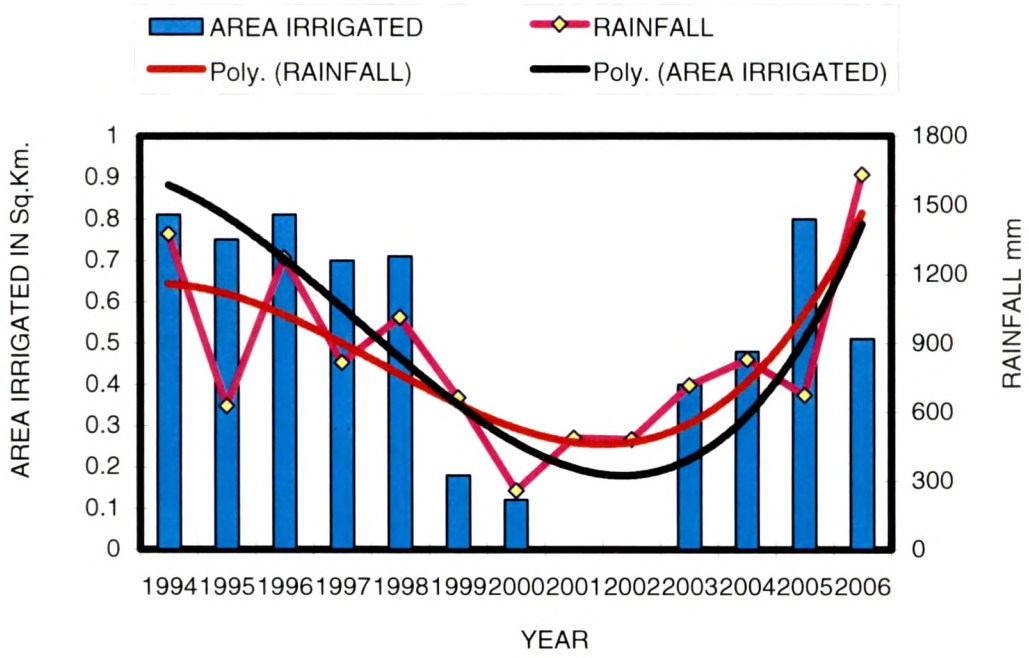
Graph – 7.39 Area Irrigated by Therka Check Dam



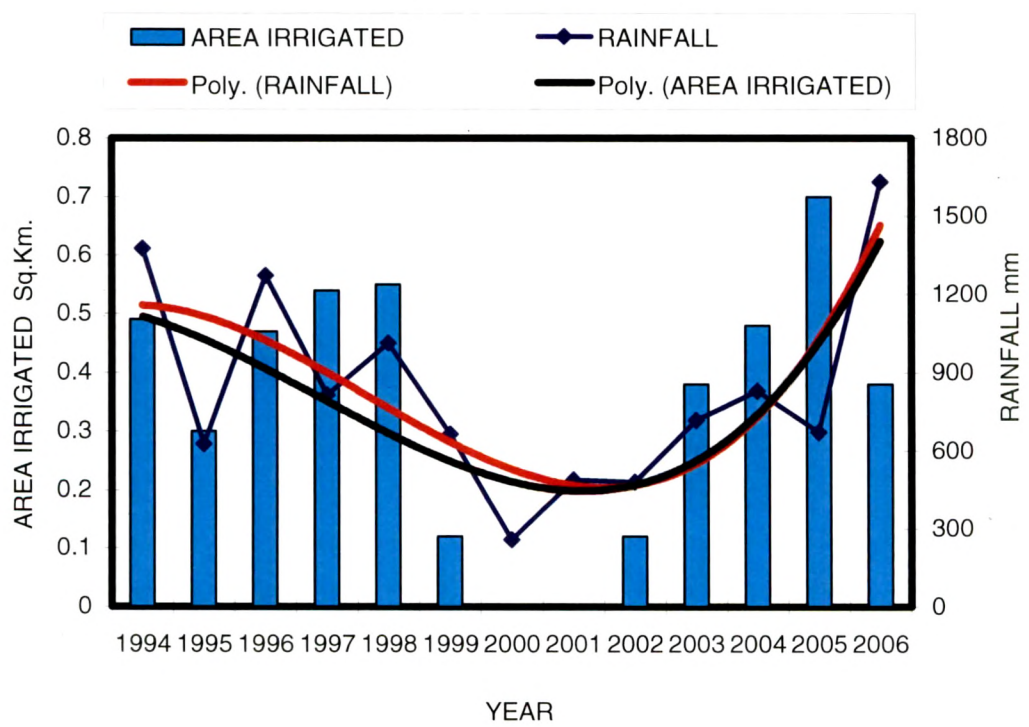
Graph – 7.40 Area Irrigated by Bambela Check Dam



Graph – 7.41 Area Irrigated by Mahudi Check Dam

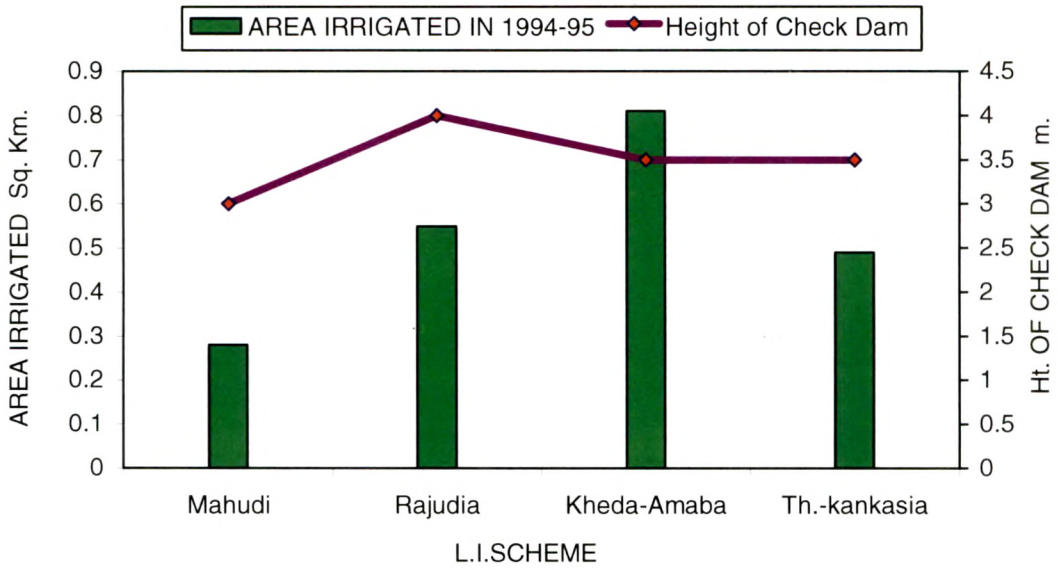


Graph – 7.42 Area Irrigated by Kheda-Amba Check Dam

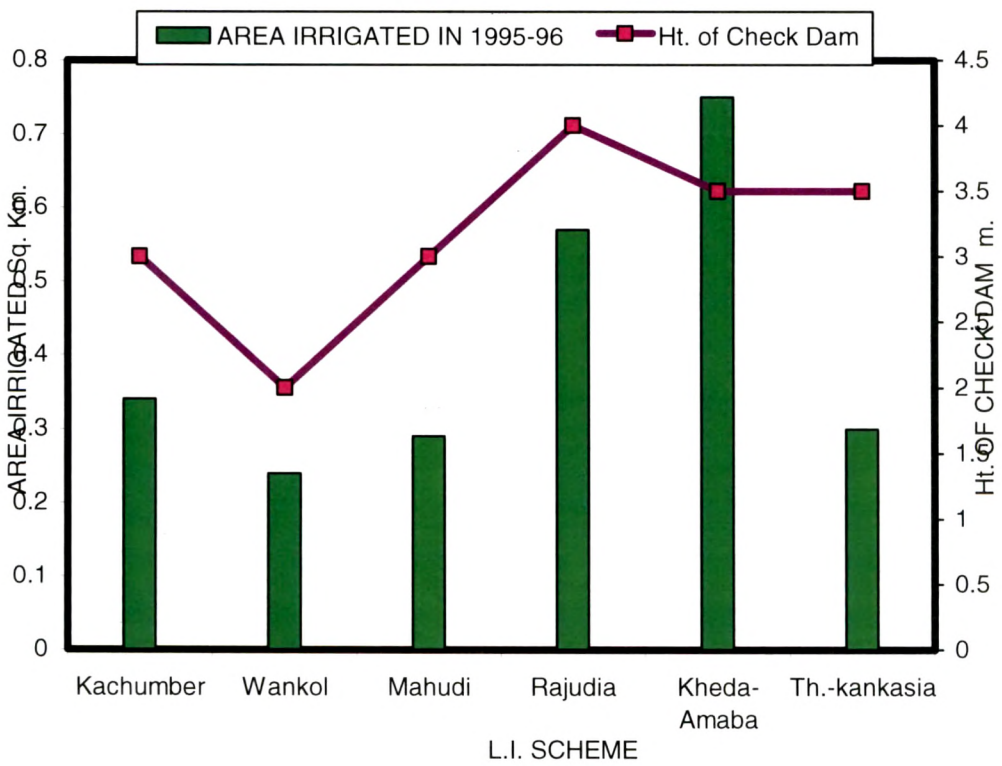


Graph – 7.43 Area Irrigated by Thunthi-Kankasiya Check Dam

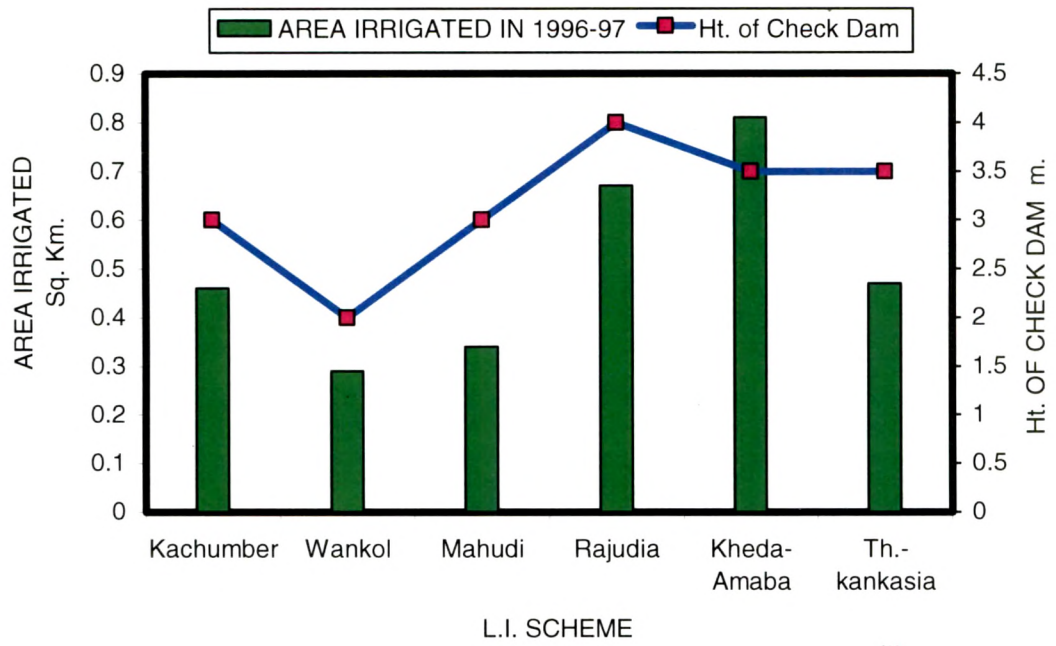
7.3.2 Comparative Analysis of Area Irrigated by Different Check Dams In Different Years



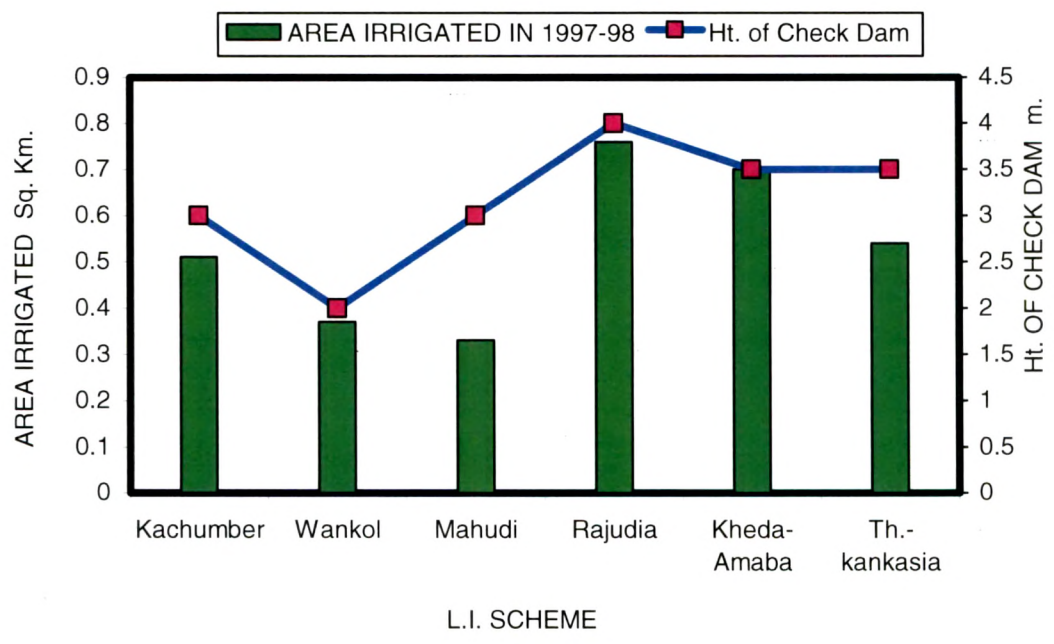
Graph – 7.44 Area Irrigated in 1994



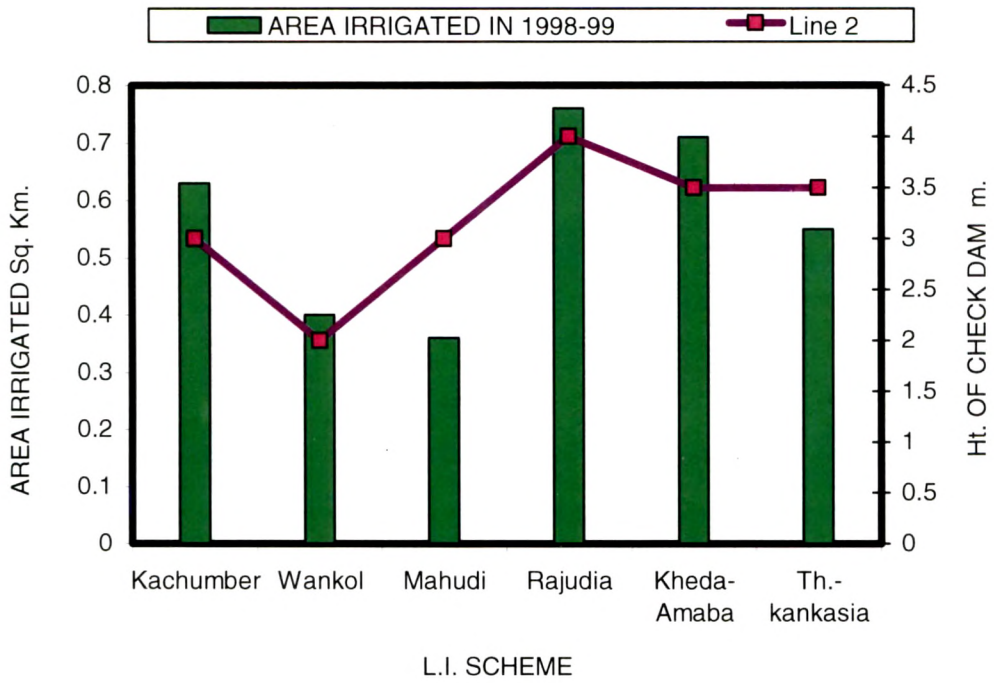
Graph – 7.45 Area Irrigated in 1995



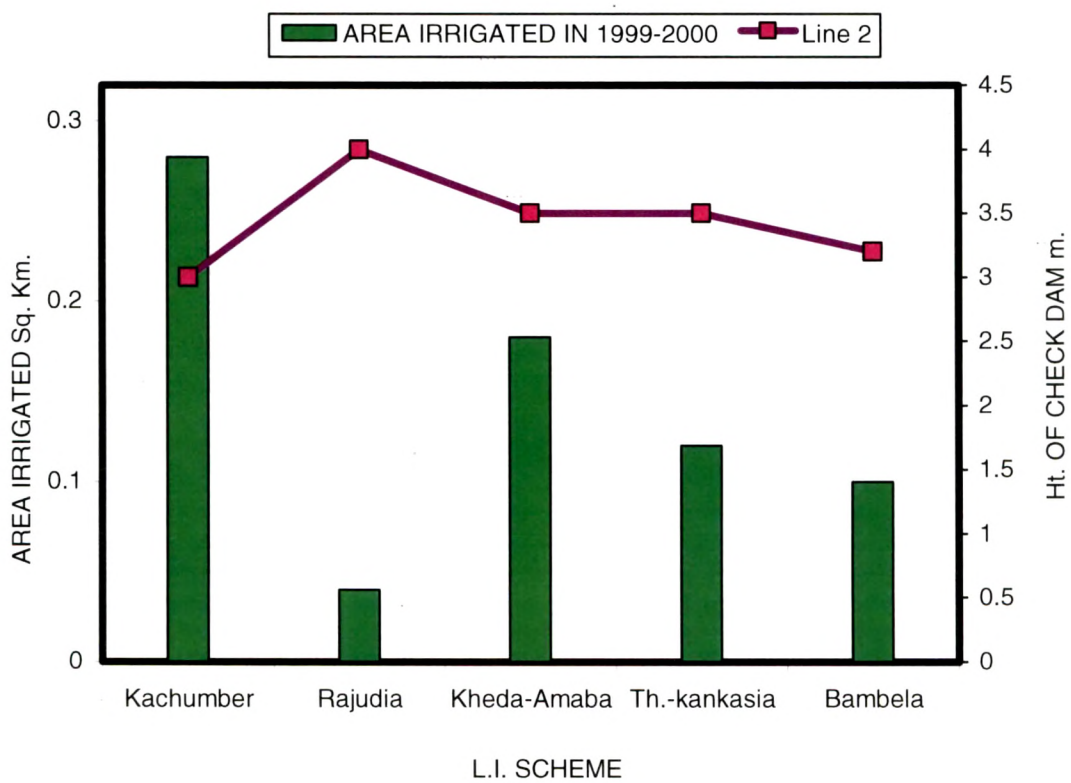
Graph – 7.46 Area Irrigated in 1996



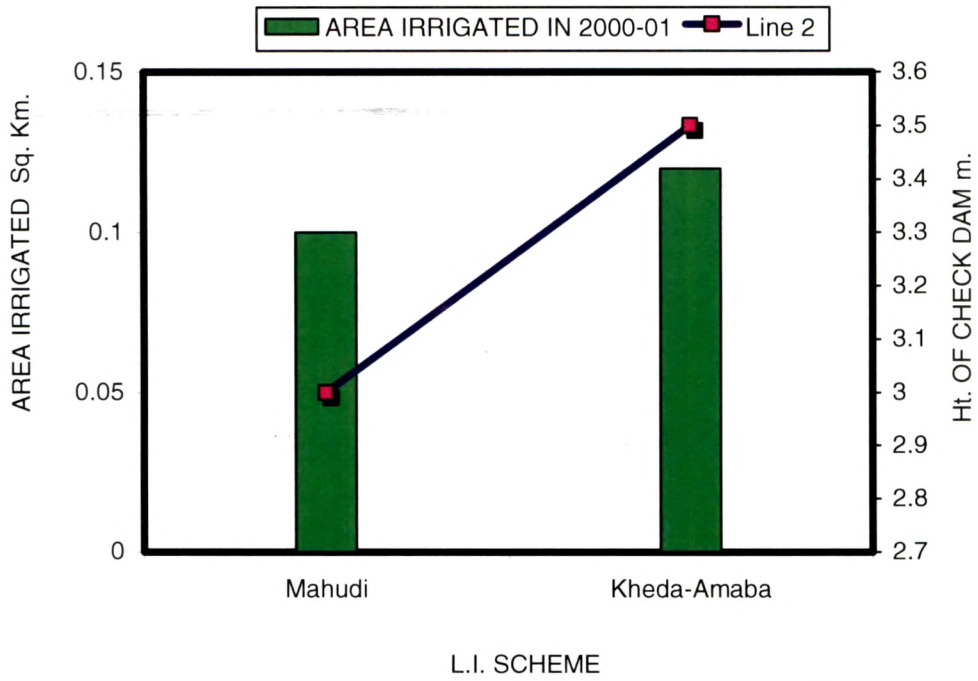
Graph – 7.47 Area Irrigated in 1997



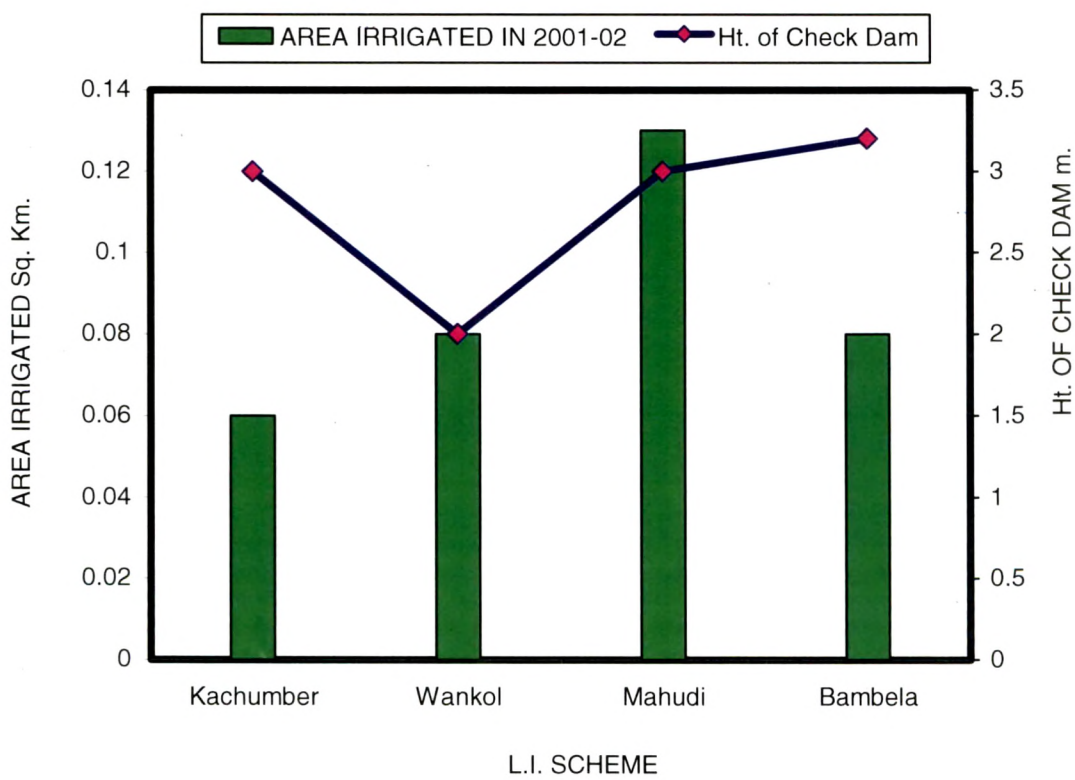
Graph – 7.48 Area Irrigated in 1998



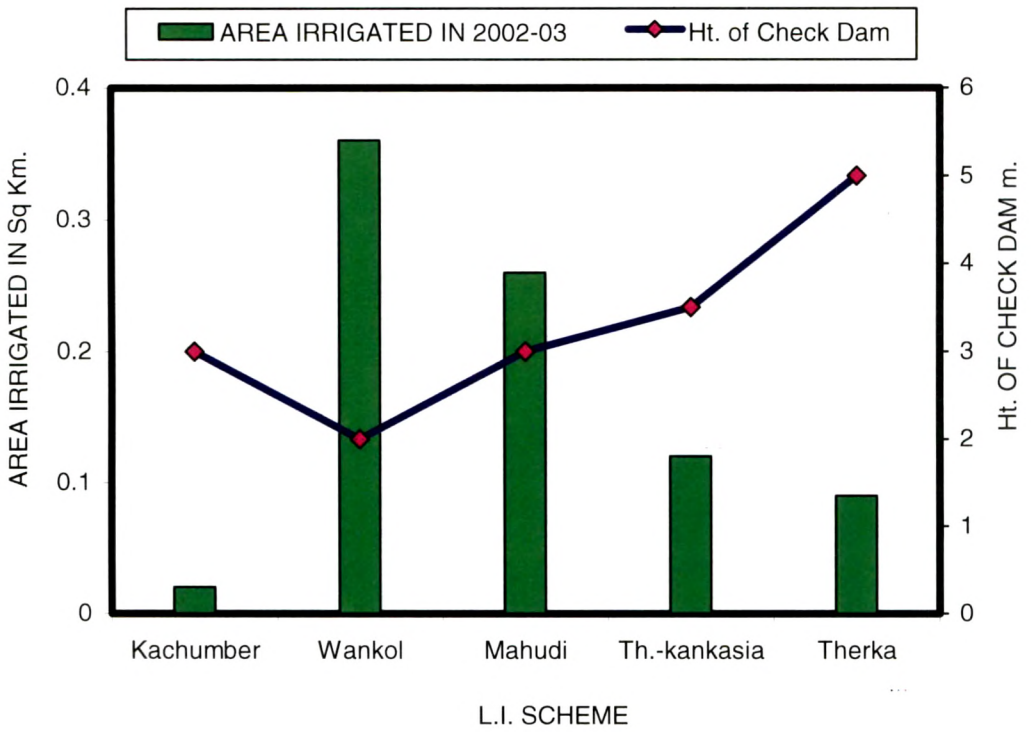
Graph – 7.49 Area Irrigated in 1999



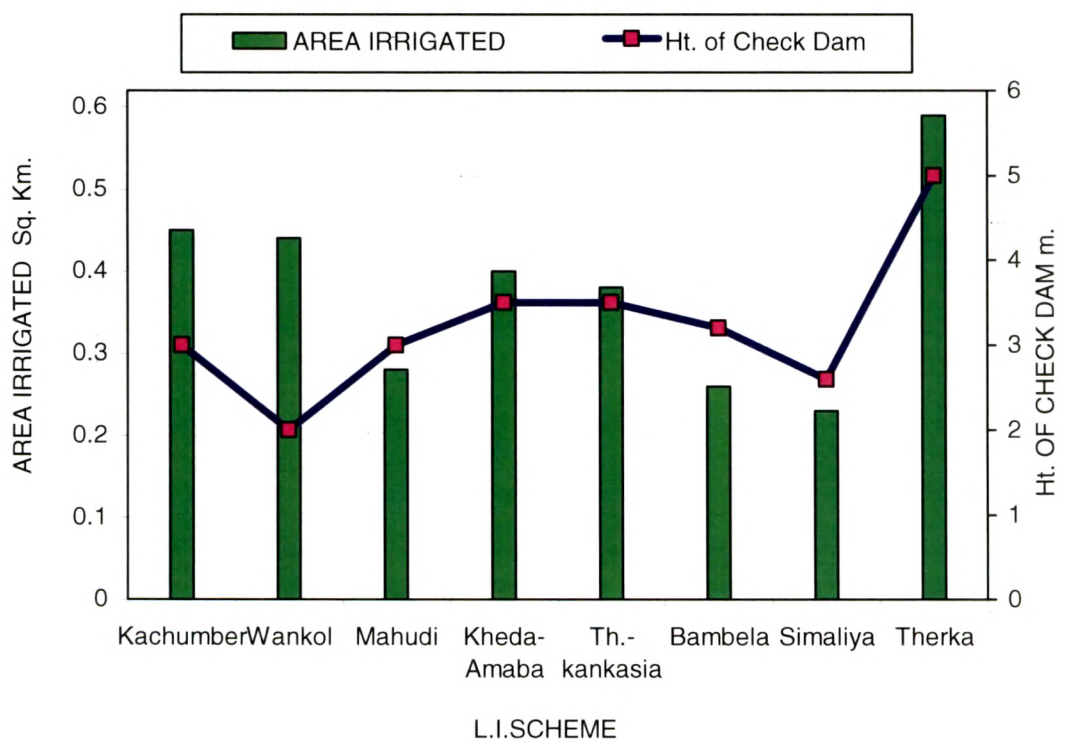
Graph – 7.50 Area Irrigated in 2000



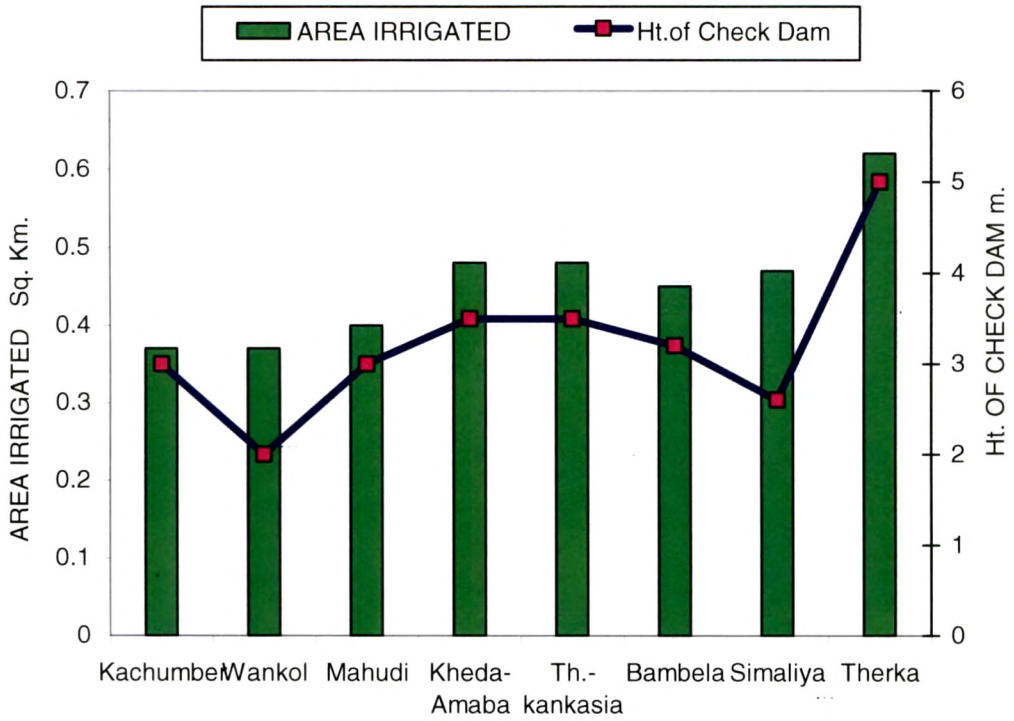
Graph – 7.51 Area Irrigated in 2001



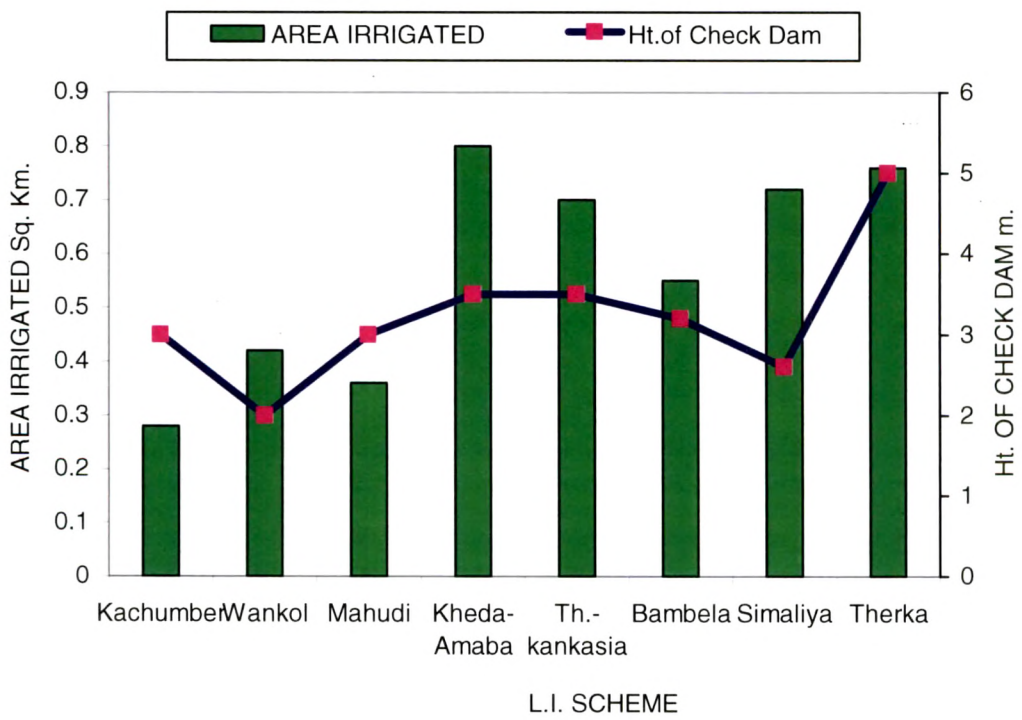
Graph – 7.52 Area Irrigated in 2002



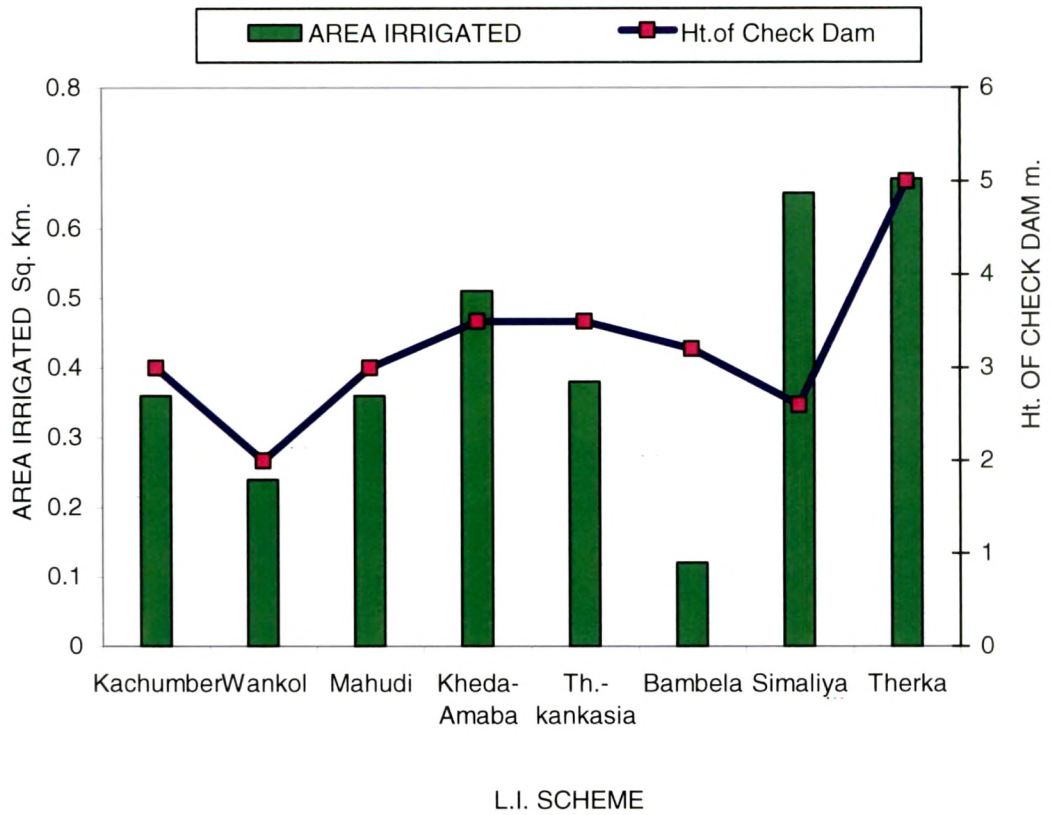
Graph – 7.53 Area Irrigated in 2003



Graph – 7.54 Area Irrigated in 2004



Graph – 7.55 Area Irrigated in 2005



Graph – 7.56 Area Irrigated in 2006

7.3.3 Discussion on Analysis of Irrigation from Check Dams

Graphs 7.36 to 7.43 shows area irrigated by different check dams individually. It is observed that the area irrigated variation follows pattern of rainfall variation. However from year 2003 to 2004 rainfall decreased even though area irrigated has been increased.

Year 1994 was year of one of the highest rainfall 1350 mm. In this year irrigation from four lift irrigation schemes was practiced. In 1995 this number increased to 6 in spite of fact that the rainfall was very less, less than 50 % of the previous year. Up to 1998 irrigation is found to have been practiced from L.I. Schemes at 6 places though rainfall was varying from as high as 1258 mm in 1996 to 828 in 1997 and 1037 mm in 1998. In 1999 rainfall was less, 630 mm and irrigation could be practiced from 5 LI schemes. No irrigation was done from the L.I. Scheme at Wankol.

Year 2000 was the year of severe drought hence irrigation could be done from only two LI Schemes Mahudi and Kheda-Amba. Situation little improved in 2001 with rainfall of 492 mm and irrigation could be availed from 4 LI Schemes. Year 2002 was year of lowest rainfall, 205 mm. even though irrigation was done from 5 LI Schemes. Since 2003 irrigation from 8 LI schemes is done.